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GUIDELINES FOR DESIGN OF HORIZONTAL CURVES FOR HIGHWAYS AND DESIGN TABLES

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GUIDELINES FOR DESIGN OF HORIZONTAL CURVES FOR HIGHWAYS AND DESIGN TABLES

(First Revision)

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FOREWORD

The Horizontal Curve is one of the most important element in designing the highway. The introduction of properly designed horizontal curves is essential for smooth and safe driving especially when the traffic is moving at high speeds. Readymade tables for the selection and set-out of Horizontal Curves were first brought out by the Indian Roads Congress in 1970 as IRC : 38-1970 "Design Tables for Horizontal Curves for Highways". These Design Tables, which were in FPS units, were prepared in the Standards Section of the Roads Wing.

Over the years, IRC : 38-1970 has been widely used throughout the country. The need for conversion of the Design Tables into metric units was, however, keenly felt by the profession. The Design Tables also required revision to take into account the many changes introduced in the geometric design standards. The task of revising the Design Tables was taken up by Shri J.B. Mathur, Deputy Secretary (Research), the Present Director, Indian Roads Congress in August, 1985. These were revised with the aid of a Computer and the text was re-written where necessary. The revised text and new Design Tables were considered by a Panel of Experts under the Convenorship of Shri N. Sivaguru, which included S/Shri I.J. Mamtani, D.S.N. Iyyar, S.K. Malhotra, P.K. Lauria, R.K. Saxena, Dharm Vir, Dr. A.C. Sarna, Dr. A.K. Gupta, Dr. L.R. Kadiyali and J.B. Mathur.

The draft was approved by the Specifications and Standards Committee of the Indian Roads Congress in their meeting held at New Delhi on the 28th August, 1986 and then by the Executive Committee in their meeting held at New Delhi on the same day. Later it was approved by the Council of the Indian Roads Congress in their 117th meeting held at Srinagar on 19th September, 1986.

Since the utility of the earlier Design Tables has been proved beyond question, I am confident that the revised tables in metric units will be even more widely used and will greatly benefit highway engineers all over the country in their day to day working.

Dated : September 1989

K.K. Sarin
Director General (Road Development)

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GUIDELINES FOR DESIGN OF HORIZONTAL CURVES FOR HIGHWAYS AND DESIGN TABLES

1. INTRODUCTION

1.1. The modern concept of highway geometric design is to consider the highway as an aesthetic whole blending with the landscape. It is an abstract composition in space, which is not only passively seen but is felt by the driver who experiences visual as well as kinesthetic sensation of tilting, turning, dropping and climbing while travelling on it. With this end in view the horizontal and vertical geometrics of highways are developed as a composite unit using topographic and stereo photographic information and applying computer technology wherever possible to speed up the refinement. The aim now a days is to provide gentle slopes and mild curves that fit the natural terrain and are more aesthetic.

1.2. In a road alignment changes in direction are often necessary due to restrictions imposed by topography, environmental and ecological qualities of areas, presence of monuments, places of worship, sites of structures and other considerations such as available land. For convenient, safe and pleasant travel on the road, changes in directions have to be accomplished by introducing horizontal and transition curves in the alignment. There is, however, some reluctance on the part of field engineers to build transition curves as it involves tedious and laborious calculation. This standard is intended to take out the sting from the whole exercise and to encourage the field engineers in use of transitional curves. A set of ready reckoner tables have been given here to enable design engineer to choose the one best suited to the field conditions. In the absence of computer systems for alignment, these tables will be a valuable tool in both designing and field layout of transition curves.

1.3. The general principle of design to be followed while using these curves, is to coordinate both the horizontal and the vertical alignments. Some of the important considerations are summarised below :

(1) Sharp horizontal curves should be avoided at or near the apex of pronounced summit/sag vertical curves from safety considerations.

(2) Vertical curvature superimposed upon horizontal curvature gives a pleasing effect. As such the vertical and horizontal curves should coincide as far as possible and their length should be more or less equal. If this is difficult for any reason, the horizontal curve should be somewhat longer than the vertical curve.

(3) The degree of curvature should be in proper balance with the gradients. Straight alignment or flat horizontal curves at the expense of steep or long grades, or excessive curvature in a road with flat grades, do not constitute balanced designs and should be avoided.

(4) Fig. 1, illustrates some typical cases of good and bad alignment co-ordination.

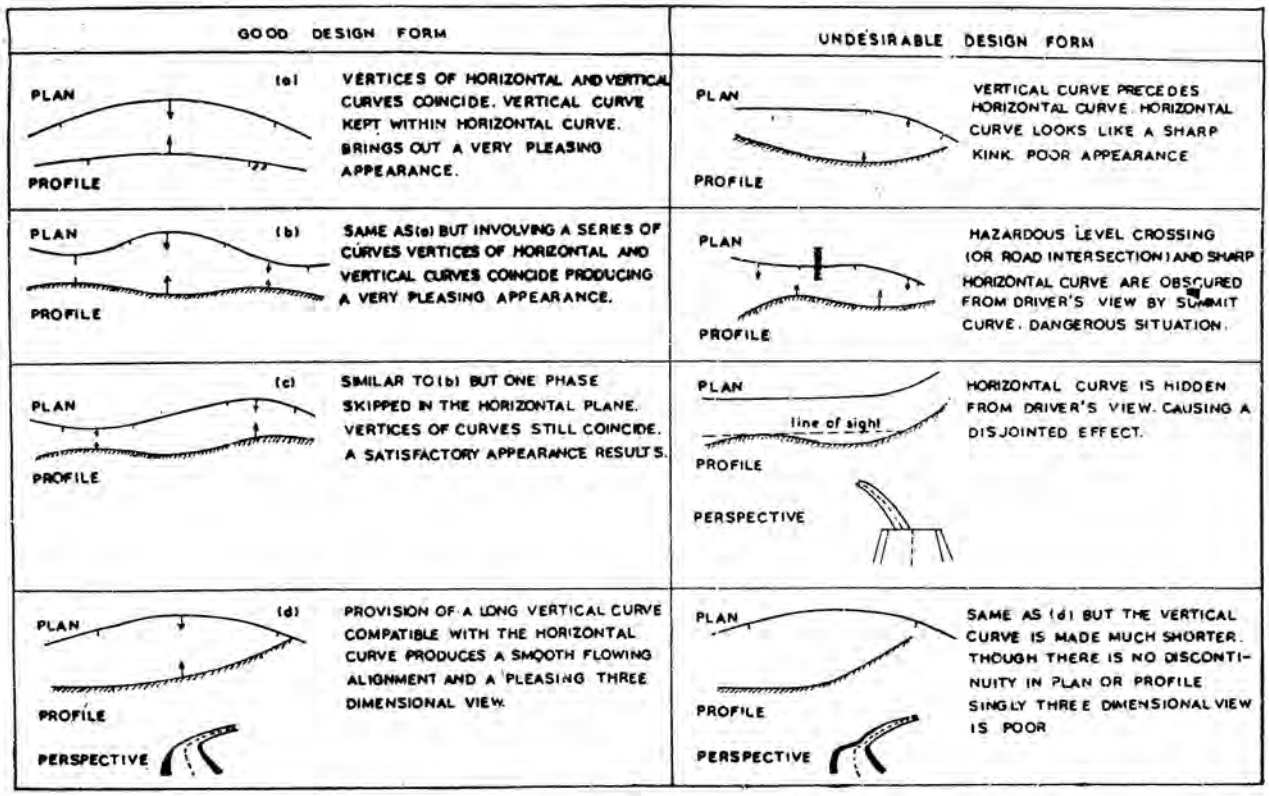


Fig. 1. Sketches illustrating good and bad alignment co-ordination

2. DEFINITIONS AND NOTATIONS

Definitions of terms, abbreviations and symbols used in this book are given below. Synonymous terms are given in brackets below the term; their use, however, is deprecated. Symbols for certain terms are given in brackets below the term. Figs. 2 and 3 illustrate the symbols and abbreviations.

TERM	DEFINITION
1. APEX OF A CURVE (VERTEX) (P.I.)	The point of intersection of the two straights connected by curve.
2. APEX DISTANCE (E_s)	The shortest distance from the apex to the curve.
3. CURVE RADIUS (R_c)	The minimum radius of the centre line of a curve.
4. INTERSECTION ANGLE (180-Δ)	The internal angle of intersection between the tangents at the two ends of a curve. This is the supplement of the deviation angle.
5. LONG CHORD (P_c/L.C.)	The length of polar ray from beginning to end of transition i.e., T.P. to C.T.
6. LONG TANGENT (L.T.)	The distance along the straight (T.P.–P.I.) from T.P. to the intersection of the tangent to the curve at C.T.

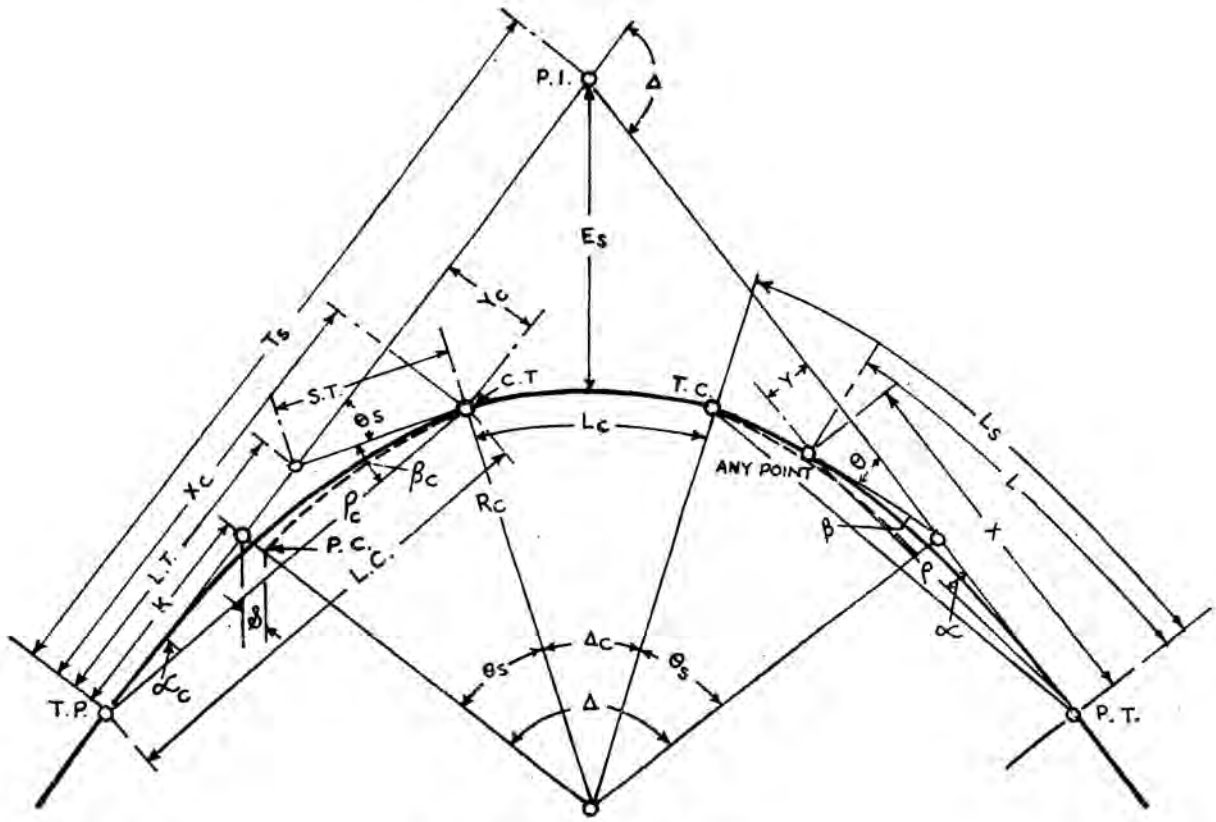


Fig. 2. Circular curve with transition

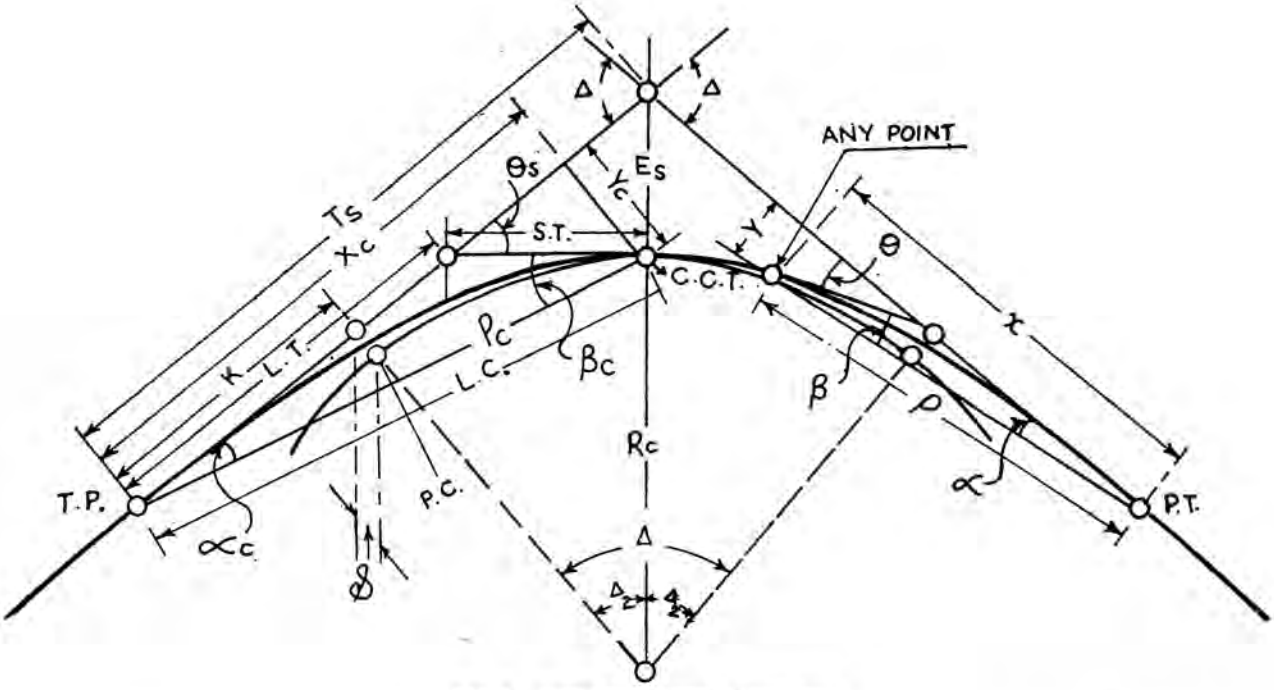


Fig. 3. Curve transitional throughout

7. SHIFT (S) — The displacement of a circular curve from the straight to provide room to introduce a transition curve between it and the straight, the distance of P.C. from the straight T.P.—P.I.

8. SHORT TANGENT (S.T.) — The length of the tangent to the curve at C.T. from C.T. to the straight (T.P.—P.I.).

9. TANGENT DISTANCE (T_s) — The length of the straight between the apex (P.I.) and the tangent point of the curve (P.T. or T.P.)

10. TANGENT POINT (T.P. OR P.T.) — The point where the straight alignment ceases and curvature begins. Also the point of reversal of curvature.

11. TOTAL DEVIATION ANGLE (△) — The external angle at the intersection between the tangents at the ends of a curve. This measures the total change of direction in the alignment of the route. This is also the central angle of the complete curve.

12. TRANSITION LENGTH (L_s) — The full length of the transition curve connecting a straight length of road with a curve which may be circular or transitional.

13. C. C . T. (Refer Fig. 2) — The mid point of the curve transition throughout i.e., where the total deviation is effected through two transitional curves without a circular arc intervening.

14. C. T. and T. C. — The nearer and farther points on a curve where the transition changes to circular arc.

	TERM	DEFINITION
15.	f	The coefficient of lateral friction between the tyre of a moving vehicle and road surface and equal to tan ϕ.
16.	g	The acceleration due to gravity in metre per second per second equals 9.8 metre per second^2.
17.	K	The distance along the straight from T. P. to P. C.
18.	L	The length of the transition from T. P. to any point on the transition.
19.	L_c	Length of circular arc C. T. to T. C.
20.	L_s	Length of transition from T. P. to the point where maximum designed superelevation is reached.
21.	l	The wheel base of a vehicle in metres.
22.	n	The number of traffic lanes provided in the carriageway width.
23.	P. C.	The point on the circular curve produced nearest to the straight.
24.	R	The radius of the curve in metres at the point under consideration.
25.	R_s	The radius of a transitional curve at the point where maximum designed superelevation is reached.
26.	V	The speed in kilometres per hour.
27.	v	The speed in metre per second.
28.	W	The weight in kilograms of the moving body.
29.	W_e	The extra width in metre to be provided at curves.
30.	X, Y	Co-ordinates to any point on the transition with T. P. as origin, the straight T. P.—P. T. as X axis and Y axis at right angles to T. P.—P. I at T. P.
31.	X_c, Y_c	Co-ordinates of C. T. X_c being measured from T. P. along the tangent T. P.—P. I. and Y_c at right angles to it.
32.	α	Polar deflection angle at T. P. from the straight to any point on the transition.
33.	α_c	Polar deflection angle (at T. P.) between the long tangent and the long chord. The long chord and the polar deflection angle define the position of C. T. or C. C. T.
34.	β	The angle between the polar ray to any point on the transition and the tangent to the curve at that point.
35.	β_c	The angle between the polar ray to C. T. and the tangent to the curve at that point.

	TERM	DEFINITION
36.	ρ	Length of polar ray to any point on the transition.
37.	ϕ	The angle of friction between the tyre and the road surface. The tangent of this angle is the coefficient of friction (f).
38.	θ	The angle between the tangent to the curve at any point on the transition and the straight approach or the tangent at T. P.
39.	θ_s	The tangent deflection angle for the end of the transition curve, i.e., the external angle between the straight and the tangent to the curve at the end of the transition.
40.	Δ_c	Deviation angle or central angle of the circular part of a curve with a transition at either end.

3. DESIGN SPEEDS FOR VARIOUS CLASSIFICATIONS OF ROADS

3.1. While travelling on highways some drivers choose speeds higher than others. Some passengers feel more comfortable at a speed lower than others.

The speed with which vehicles travel on the road is seldom the maximum speed the vehicle is capable of. Higher speeds are generally possible in flat country than in hill country with steep gradients where speeds have to be low. In urban areas, traffic control by policemen or lights, frequent intersections, etc., tend to lower speeds than in open country where greater visibility and freedom from traffic interruptions exist. So it is not possible to design various components of the road to cater to the diverse needs.

It should generally be the aim to design a highway to permit a constant speed in any one section. This is an advantage in that, the drivers can anticipate the movements of other vehicles and can adjust their own movements suitably.

3.2. Generally, on an important, highway which carries large volume of traffic, a design speed higher than on a less important one traversing similar topography is justified. On the other hand, very low design speed could not be assumed even for an unimportant road as travel at such a low speed is not conducive to overall economy. While it is costly to design roads for the potential speed the modern vehicle is capable of, the cost of designing an alignment beyond a certain minimum has to be balanced against the gain in the operation of vehicles. Also travel at very high speeds causes accidents.

3.3. Therefore, considering the above mentioned factors, a speed "which is the maximum approximately uniform speed that will probably be adopted by the faster group of drivers but not necessarily by a small percentage of the reckless ones" is specified for designing roads of each of the classifications current in the country.

3.4. Choice of design speed depends on the function of the road as also terrain conditions. Terrain is classified by the general slope of the country across the highway alignment, for which the criteria given in Table 1 should be followed. While classifying a terrain, short isolated stretches of varying terrain should not be taken into consideration. It is the basic parameter which determines all other geometric design features. Design speeds for various classes of roads should be as given in Table 2.

TABLE 1. TERRAIN CLASSIFICATION

S. No.	Terrain classification	Per cent cross slope of the country
1.	Plain	0-10
2.	Rolling	10-25
3.	Mountainous	25-60
4.	Steep	Greater than 60

TABLE 2. DESIGN SPEEDS

Sl. No.	Road classification	Design speed, km/h							
		Plain terrain		Rolling terrain		Mountainous terrain		Steep terrain	
		Ruling design speed	Minimum design speed	Ruling design speed	Minimum design speed	Ruling design speed	Minimum design speed	Ruling design speed	Minimum design speed
1.	National and State Highways	100	80	80	65	50	40	40	30
2.	Major District Roads	80	65	65	50	40	30	30	20
3.	Other District Roads	65	50	50	40	30	25	25	20
4.	Village Roads	50	40	40	35	25	20	25	20

3.5. Normally "ruling design speed" should be the guiding criterion for correlating the various geometric design features. "Minimum design speed" may, however, be adopted in sections where site conditions, including costs, do not permit a design based on the "ruling design speed".

3.6. The design speed should preferably be uniform along a given highway. But variations in terrain may make changes in speed unavoidable. Where this is so, it is desirable that the design speed should not be changed abruptly, but in a gradual manner by introducing successive sections of increasing/decreasing design speed so that the road users get conditioned to the change by degrees. If the provision of components of adequate design is not possible or is prohibitively costly, a warning sign should be erected well ahead of the point of danger.

4. DESIGN OF CIRCULAR CURVE RADIUS

4.1. Dynamics of Motion of a Vehicle on a Curve

When a vehicle travels around a curve of constant radius at constant speed, it exerts radially an outward force known as the 'Centrifugal force'. This centrifugal force (P) can be represented by

$$P = \frac{Wv^2}{gR} \quad \ldots \quad (1)$$

$$= \frac{Wv^2}{127\,R} \quad \ldots \quad (2)$$

It acts horizontally at the centre of gravity of the vehicle and its load. The forces acting on the vehicle are

(1) the centrifugal force acting radially outwards,

(2) the weight of the vehicle acting vertically downwards, and

(3) the upward reaction of the road on the vehicle.

For equilibrium the centrifugal force must be counteracted either by lateral friction developed between the tyre and the road surface alone, by the inward tilt of the road surface known as superelevation alone or partially by friction and partially by superelevation while the weight of the vehicle is balanced by the reaction of the road on the vehicle. When the surface is level laterally, i.e., when there is no camber or superelevation, the centrifugal force has to be resisted by the friction between the tyres and the road surface. There will be unequal distribution of pressure on the wheels, the outer wheel taking more, Fig. 4. When superelevation is exactly equal to the centrifugal force, there will be equal distribution of pressure between the wheels, Fig. 5 and no friction would be developed between the tyres and the road surface. When the centrifugal force is counteracted partially by superelevation and partially by friction, the pressure on the wheels will be intermediate between those mentioned above. Figs. 6, 7 and 8 show the forces acting at equilibrium for the three conditions.

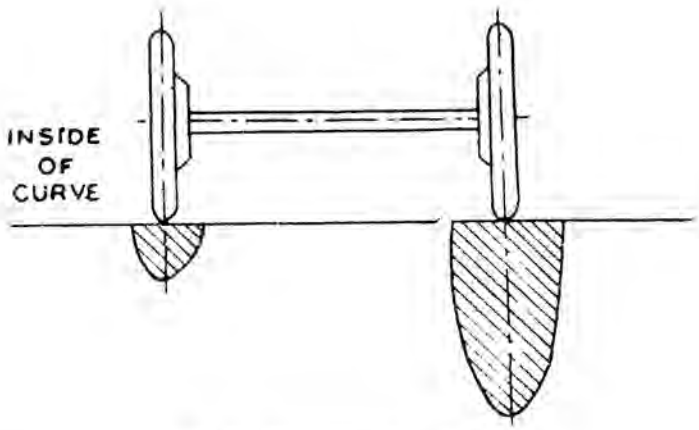


Fig. 4. No superelevation provided

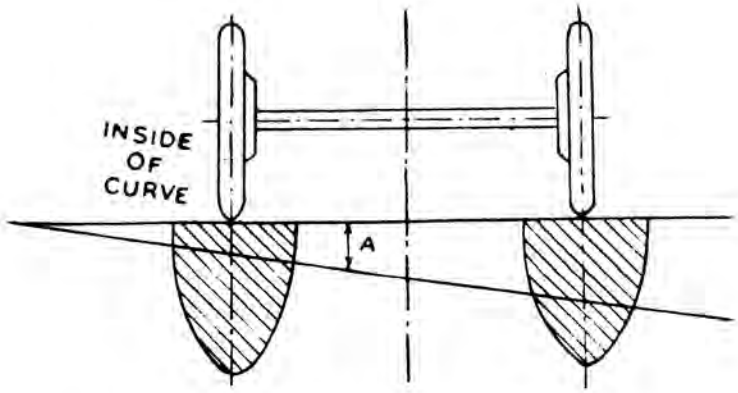


Fig. 5. Superelevation equal to centrifugal force

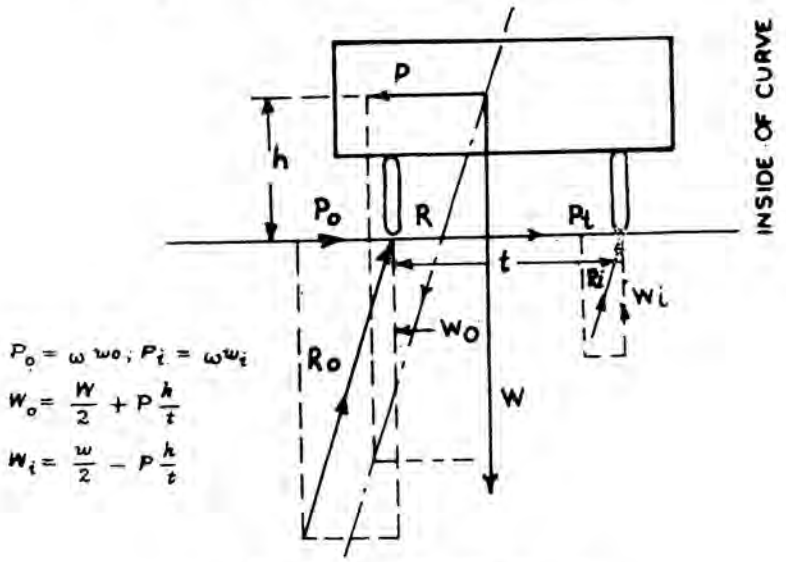


Fig. 6. Curve with no superelevation

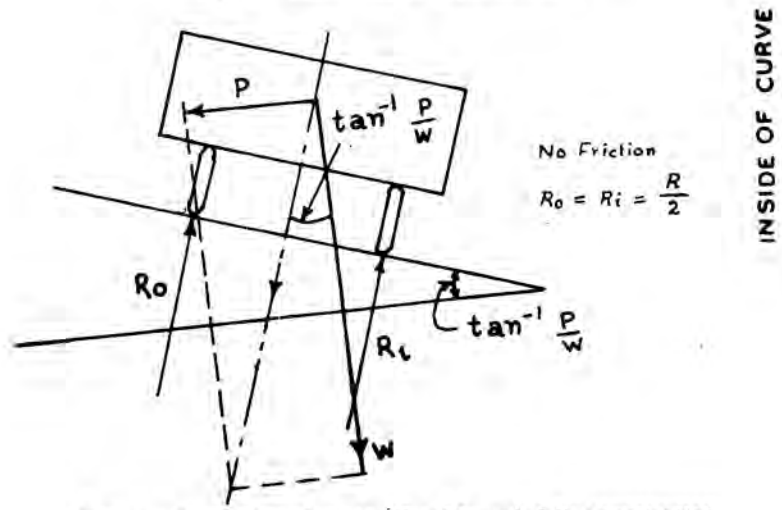


Fig. 7. Curve where the centrifugal force is fully counteracted by superelevation

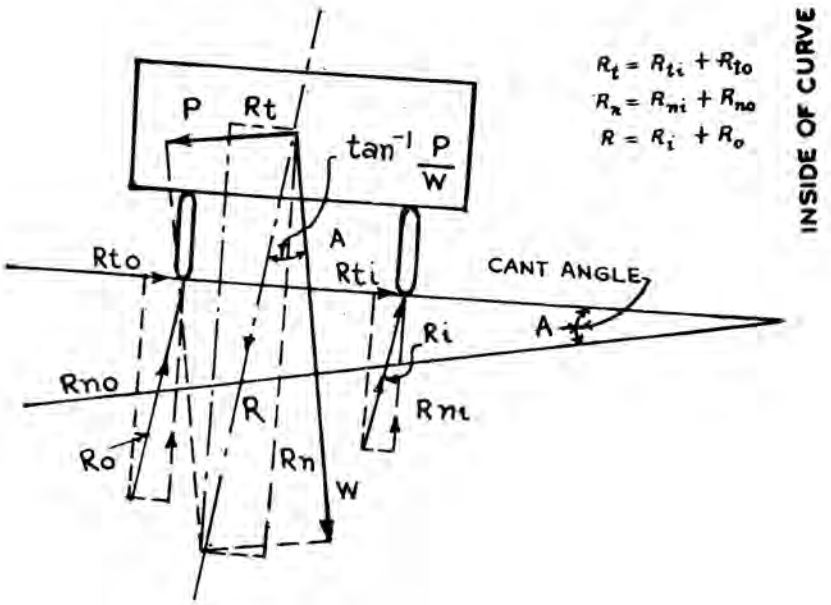


Fig. 8. Curve where centrifugal force is counteracted partly by friction and partly by superelevation

It can be mathematically shown that the centrifugal ratio

$$B = \frac{P}{W} = \frac{V^2}{127\,R} = \tan(A + \phi) \quad \ldots \quad (3)$$

$$= \tan A + \tan \phi \text{ for small values of } A \text{ and } \phi \text{ found in practice} \quad \ldots \quad (4)$$

$$= e + f \quad \ldots \quad (5)$$

From Equation (3) and (5) it is seen that the factors to be taken into account in determining the speed of the curve are the allowable friction, the maximum allowable superelevation and the maximum permissible centrifugal ratio.

4.2. Friction between the Tyre and Road Surface

The value of the coefficient of lateral friction is a function of speed of the vehicle, the type and condition of the road surface, the condition of the tyres, the weather conditions at the time of contact between tyre and the road, the temperature of the road, etc. Tests indicate that the coefficient of lateral friction is as low as 0.2 when the pavement is covered with mud. Allowing a factor of safety of $1\frac{1}{3}$, the safe value of friction for design of curves is taken as 0.15.

4.3. Maximum Allowable Superelevation

In India, for a long time to come, the slow-moving bullock carts would continue to use the roads. Often these carry light bulky commodities such as hay, with its centre of gravity very high. It has been observed that a transverse slope of more than 70 per cent is inconvenient to the slow-moving vehicle. So that maximum allowable superelevation on curves is taken as 7 per cent. In hilly areas, since such carts are not prevelant and the number of curves are more, a higher superelevation is permitted. A value of 10 per cent is recommended for design in hilly areas not effected by snow. Again where snow makes the road slippery, maximum allowable superelevation is limited to 7 per cent.

4.4. Minimum Curve Radius

4.4.1. The minimum curve radii are governed by two factors : (i) the design speed and allowable superelevation and friction; (ii) the minimum turning radii of design vehicle.

4.4.2. The maximum allowable values of superelevation and friction, i.e.. $e = 0.07$ to 0.1, and $f = 0.15$, limit the centrifugal ratio to 0.22 to 0.25. Therefore, $\frac{V^2}{127\,R}$ for the sharpest permissible curvature equals to 0.22 to 0.25. Therefore, $\frac{V^2}{127\,R} = 0.22$ to 0.25 the absolute minimum radius for any design speed $= \frac{V^2}{(0.22 \text{ to } 0.25) \times 127}$ or $0.0358\,V^2$ to $0.0315\,V^2$... (6)

4.4.3. Table 3 gives the desirable minimum radii of curves for various design speeds.

TABLE 3. MINIMUM RADIUS OF HORIZONTAL CURVES FOR DIFFERENT TERRAIN CONDITIONS FOR MINIMUM DESIGN SPEEDS

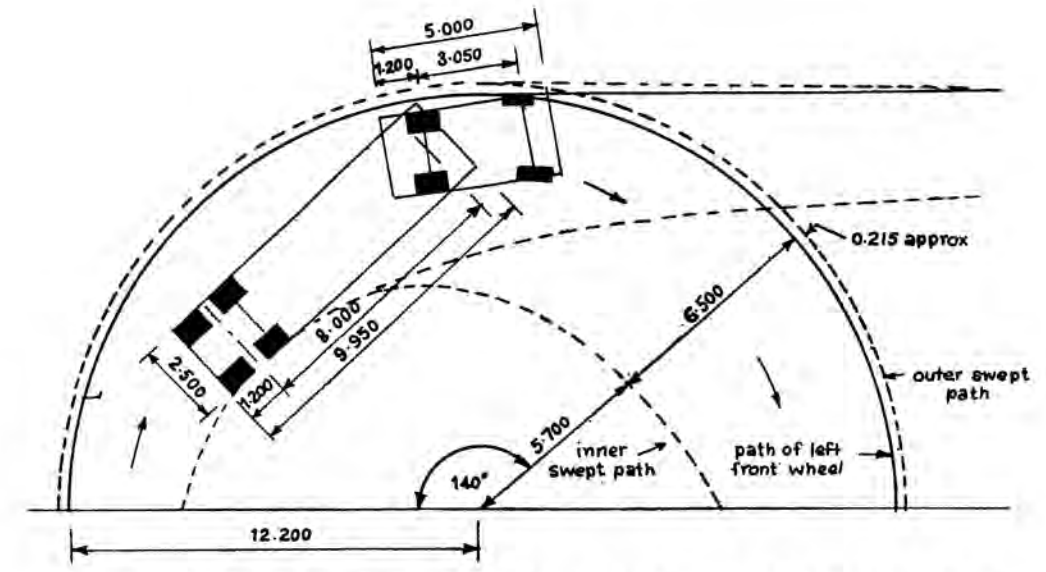
Design Speed	Plain & Rolling Terrain (Metres)	Mountainous and Steep Terrain	
		Snow Bound Area (Metres)	Non-snow Bound Area (Metres)
20	15*	15*	14*
25	23*	23*	20*
30	33	33	30
35	45	45	40
40	60	60	50
50	90	90	80
65	155	Speeds not applicable	
80	230		
100	360		

*Where trucks also ply on a road, a minimum 26 m radius should be provided to accommodate them (see para 4.4.5)

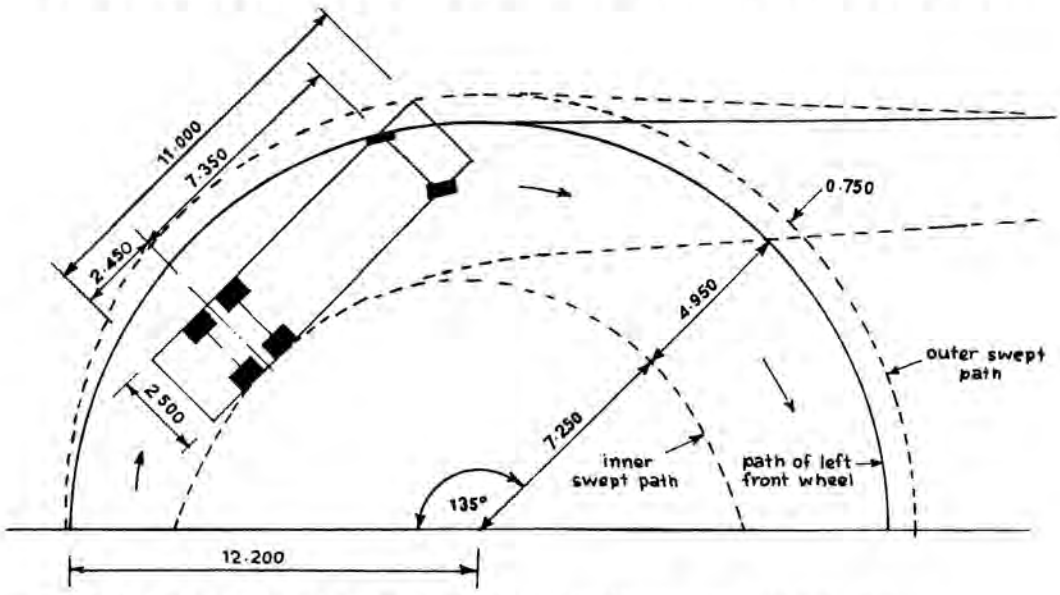
4.4.4. The values of radii given in Table 3 are the minimum and the engineer should design curves for the largest radius possible.

4.4.5. The minimum radius of curve is governed by the minimum turning circle of a vehicle. General values for the same are as below :

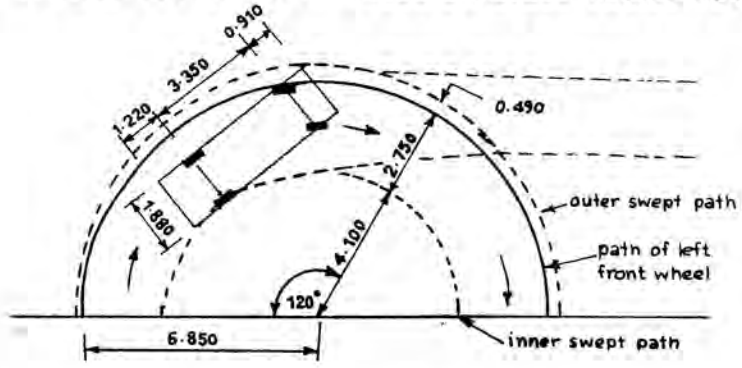
(1) Turning circles of public service vehicles have swept diameters no greater than 19.812 m for vehicles not exceeding 8.230 m in length; 21.641 m for vehicles exceeding 8.230 m but not exceeding 10.973 m in length; and 23.774 m for vehicles longer than 10.973 m. The turning circles of commercial vehicles range widely from 9 to over 26 m diameter, but lie mainly between 12 and 21 m diameter.



(1) ARTICULATED VEHICLE (OUTER FRONT WHEEL ON 12.200 RADIUS TURN)



(2) RIGID VEHICLE (OUTER FRONT WHEEL ON 12.200 RADIUS TURN)



(3) LARGE CAR (OUTER FRONT WHEEL ON 6.850 RADIUS TURN)

Fig. 9. Typical vehicular swept paths

Radii adequate for commercial vehicles will also be suitable for private cars. Car dimensions normally lie within the ranges given below :

Width 1.400 m—1.900 m

Length.....3 m—5.500 m

Turning circles.....7.600 m—13.700 m

In designing sharp curves it should be remembered that a vehicle cannot be turned from a straight path directly over to full lock and that allowance must be made for the back wheels (especially of long articulated vehicles) cutting the corner. A minimum turning radius of 26 m is therefore desirable. Typical swept paths for large commercial vehicles, both rigid and articulated, and for large cars are shown in Fig. 9.

5. SUPERELEVATION

5.1. Necessity of Superelevation

As mentioned in para 4.1, centrifugal force is counteracted by superelevation and/or friction. If the road is laterally level friction alone would have to counteract the centrifugal force and if friction developed is not sufficient, the vehicle will skid outwards. To prevent skidding, the surface of the road is given an inward tilt which is known as superelevation. When a road is superelevated, the component of the weight of the vehicle along the surface aids friction in counteracting the centrifugal force.

Also superelevating curves results in economies in maintenance. This is because skidding and unequal pressures on the wheels of vehicles which result from high value of sideway force between the tyres and the road surface, give rise to pot-holes and necessitate frequent attention to the surface.

5.2. Amount of Superelevation

5.2.1. The following methods of designing superelevation are in use :

(1) Superelevation to fully counteract the centrifugal force developed.

(2) Superelevation to counteract a fixed per cent of the centrifugal force developed.

These are discussed below :

5.2.2. Providing superelevation to fully counteract the centrifugal force would necessitate giving a superelevation of more than 7 per cent for sharp curves causing inconvenience to slow moving vehicles. Since the superelevation is limited to 7 per cent for practical reasons (see para 4.3) maximum friction would have to be relied upon when the sharpest possible curve is traversed. When a vehicle negotiates a flat curve no friction would be developed. Thus when a vehicle negotiates a sharp curve friction would be developed to the maximum and none when travelling on flat curves. This is not a balanced design. It is desirable that the superelevation should be such that a moderate amount of friction is developed while rounding flat curves and friction not exceeding the maximum allowable be developed at sharp curves. Therefore, so designing superelevation to fully counteract the centrifugal force developed at a fraction of the design speed of the highway will provide the necessary balance.

5.2.3. For a sharp curve in plain where $R = 0.038\ V^2$ with a superelevation of 7 per cent, the percentage of centrifugal ratio counteracted by superelevation is $\frac{0.07 \times 100}{0.07 + 0.15}$ or 32. If exactly 32 per cent of the centrifugal ratio is counteracted by superelevation, only the sharpest curves would have to be superelevated to 7 per cent with lesser amount of superelevation for greater radii of curves. Such a course would reduce the margin of safety to vehicles negotiating flatter curves at speeds greater than the design speeds. On the other hand, fully counteracting superelevation is objectionable because it will result in all but very flat curves being superelevated to the maximum of 7 per cent. It has also been observed that a majority of the vehicles using a highway travel at less than the design speed. Therefore, as a compromise, since we cannot provide the exact amount of superelevation required for the varying speeds of vehicles that will use the highway fully counteracting the centrifugal force developed at three-fourth of the design speed by superelevation is specified. So a curve on a National Highway with a design speed of of 80 km. p.h. would be provided with superelevation to counteract fully the centrifugal force developed at $\frac{3}{4} \times 80 = 60$ km p.h.

This method of giving superelevation will not be inconvenient to fast-moving traffic while the slow-moving vehicles would be aided. Vehicles moving faster than the design speed would not be

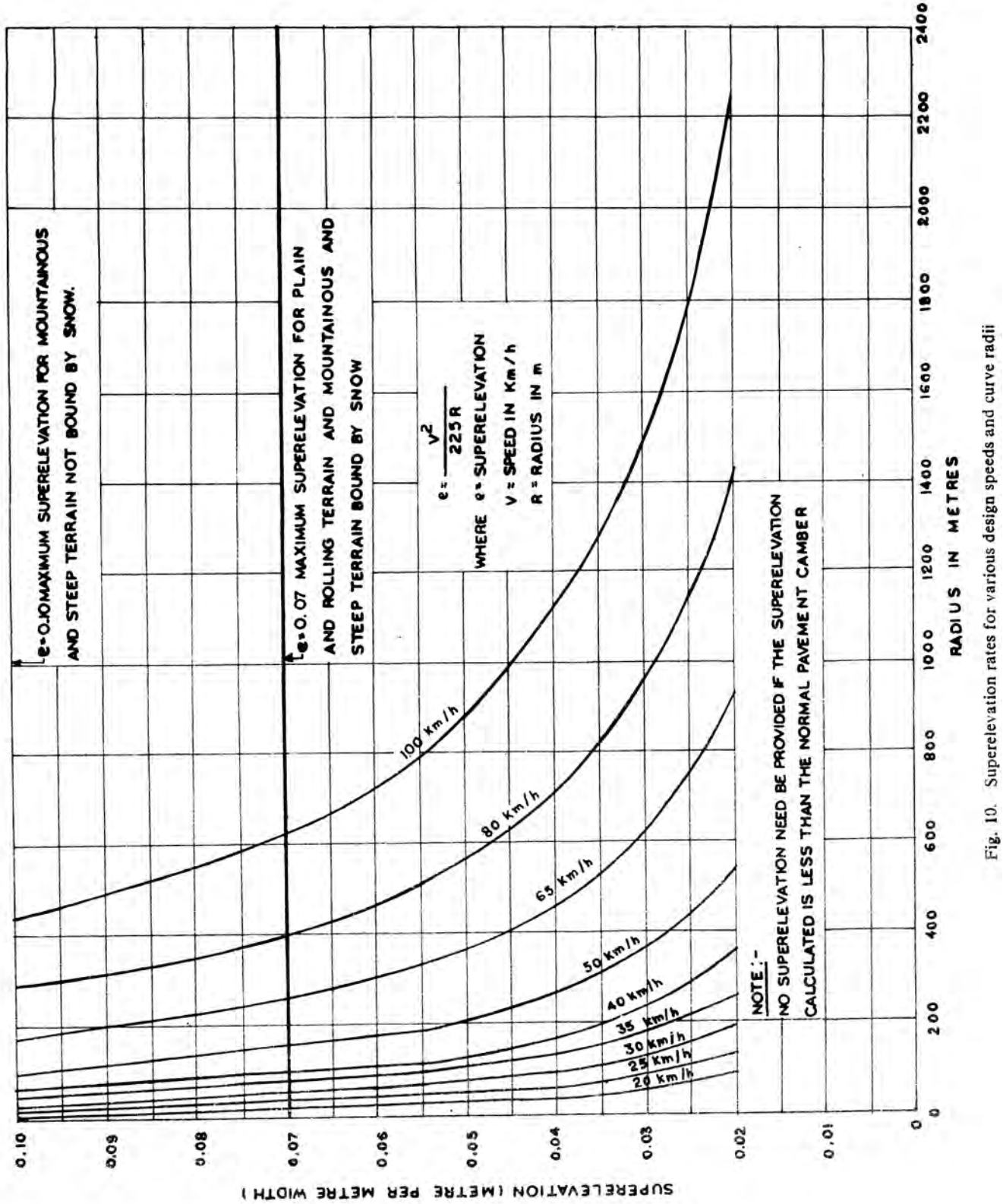


Fig. 10. Superelevation rates for various design speeds and curve radii

subjected to danger because at sharp curves, superelevation would have been the maximum in any case. Therefore, design of superelevation is given by the following equation :

$$e = \frac{(0.75V)^2}{127\,R} = \frac{V^2}{225\,R} \quad \ldots (7)$$

The value given by the equation is subject to a maximum of 7 per cent (see para 4.3). Also the superelevation given to the surface of a road should not be less than the camber required for the drainage of the surface water on the road (Table 4 and Fig. 10) gives the superelevation for different radii of curves for all the design speeds.

TABLE 4. SUPERELEVATION FOR DIFFERENT SPEEDS AND CURVE RADII

Plain/Rolling terrain, and Mountainous/Steep terrain bound by snow										Mountainous Steep terrain not bound by snow					
Curve radius R_C (metre)	Superelevation (metre per metre) for design speed (km/h) of														Curve radius R_C (metre)
	20	25	30	35	40	50	65	80	100	20	25	30	40	50	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
15	0.070	*Notes :*								0.100					15
20	0.070		(i) Superelevation has been calculated by the							0.089	0.100		(i) Maximum		20
25	0.070	0.070	Formula $e = V^2/225R_C$							0.071	0.100		Superelevation		25
30	0.059	0.070		(ii) No superelevation need be provided if						0.059	0.093	0.100	is 10 percent		30
40	0.044	0.069	0.070	the superelevation value is less than						0.044	0.069	0.100	these areas		40
45	0.040	0.062	0.070	the normal pavement camber						0.040	0.062	0.089			45
50	0.036	0.056	0 070	0.070		(iii) For a given design				0.036	0.056	0.080	0.100		50
55	0.032	0.051	0.070	0.070		speed, adopt the larg-				0.032	0.051	0.073	0.100		55
60	0.030	0.046	0.067	0.070	0.070	est possible radius be-				0.030	0.046	0.067	0.100		60
70	0.025	0.040	0.057	0.070	0.070	low the firm stepped				0.025	0.040	0.057	0.100		70
80	0.022	0.035	0.050	0.068	0.070	line				0.022	0.035	0.050	0.089	0.100	80
90	0.020	0.031	0.044	0.060	0.070	0.070	(iv) Maximum Sup-			0.020	0.031	0.044	0.079	0.100	90
100	0.018	0.028	0.040	0.054	0.070	0.070	erelevation =7			0.018	0.028	0.040	0.071	0.100	100
125		0.022	0.032	0.044	0.057	0.070	per cent				0.022	0.032	0.057	0.089	125
150		0.019	0.027	0.036	0.047	0.070	(v) Minimum				0.019	0.027	0.047	0.074	150
170		0.016	0.024	0.032	0.042	0.065	0.070	camber is			0.016	0.024	0.042	0.065	170
200			0.020	0.027	0.036	0.056	0.070	1.7 per cent				0.020	0.036	0.056	200
250			0.016	0.022	0.028	0.044	0.070	0.070				0.016	0.028	0.044	250
300				0.018	0.024	0.037	0.063	0.070					0.025	0.037	300
350				0.016	0.020	0.032	0.054	0.070					0.020	0.032	350
400					0.018	0.028	0.047	0.070	0.070				0.018	0.028	400
500						0.022	0.038	0.057	0.070					0.022	500
600						0.019	0.031	0.047	0.070					0.019	600
700						0.016	0.027	0.041	0.063					0.016	700
800						0.014	0.023	0.036	0.056					0.014	800
900							0.020	0.032	0.049						900
1000							0.019	0.028	0.044						1000
1200							0.016	0.024	0.037						1200
1500							0.013	0.019	0.030						1500
1800								0.016	0.025						1800
2000									0.022						2000
2200									0.020						2200
2500									0.018						2500
3000									0.015						3000

TABLE 5. CAMBER/CROSSFALL VALUES FOR DIFFERENT ROAD SURFACE TYPES

S. No.	Surface type	Camber/crossfall
1.	High type bituminous surfacing or cement concrete	1.7–2.0 per cent (1 in 60 to 1 in 50)
2.	Thin bituminous surfacing	2.0–2.5 per cent (1 in 50 to 1 in 40)
3.	Water bound macadam, gravel	2.5–3.0 per cent (1 in 40 to 1 in 33)
4.	Earth	3.0–4.0 per cent (1 in 33 to 1 in 25)

5.3. Radii of Curves for which no Superelevation is Required

5.3.1. When the value of the superelevation given by Equation (7) (para 5.2.3.) is less than that required for the drainage, the normal cambered profile may be continued in the curve portions also without providing any superelevation. Such a case will arise only in very flat curves where the centrifugal force developed will be very small. Therefore, when the curve is not superelevated, the frictional resistance required to keep the vehicle in equilibrium will be well within the permissible value.

5.3.2. The camber or crossfall on straight sections of roads should be as recommended in Table 5 for various types of surfaces. For a given surface type, the steeper values in the Table may be adopted in areas having high intensity of rainfall and the lower values where the intensity of rainfall is low.

Curves having radii greater than the value of R in the equation $R = \frac{V^2}{225\ e}$ where e is the camber in the straight for the type of surface concerned, will require superelevation less than the camber. These have been worked out for various speeds and given in Table 6. It is not essential that curves having radii greater than those in the Table be superelevated.

TABLE 6. RADII BEYOND WHICH SUPERELEVATION IS NOT REQUIRED

Design speed (km/h)	Radius (metres) for camber of			
	4 per cent	3 per cent	2.5 per cent	2 per cent
20	50	60	70	90
25	70	90	110	110
30	100	130	160	200
35	140	180	220	270
40	180	240	280	350
50	280	370	450	550
65	470	620	750	950
80	700	950	1100	1400
100	1100	1500	1800	2200

5.3.3. When the normal camber is continued on the curve, the outer half of the road will have a negative superelevation because of the camber. But this in the extreme cases will be 0.03. For a radius of 1500 m with a camber of 0.03, where the surface is water-bound macadam, a vehicle travelling at 100 km an hour will develop a centrifugal force of 0.052. With a negative camber of 0.03, the friction required to be developed will be only 0.082 which is much less than the safe allowable value.

5.4. Method of Building Superelevation into the Road

5.4.1. The normal cambered surface on a straight reach of road is changed into a superelevated surface in two stages. In the first stage, the outer half of the camber is gradually raised (I) until it is level, and (2) until the outer half is in line with the inner half of the cambered surface. Raising of the outer half till it is level should be done before the starting point of the curve, that is T.P., as negative superelevation due to the camber however slight, is objectionable on a curve. At the end of the first stage, the road will have a crossfall from one side to the other at a slope equal to the camber on the straight portion. Normally, the raising of the outer half should be done as not to produce a slope of more than 1 in 200.

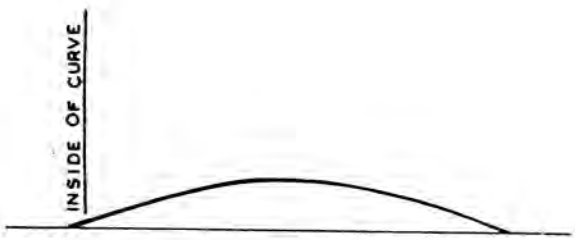


FIG. 11 (a) NORMAL CAMBER

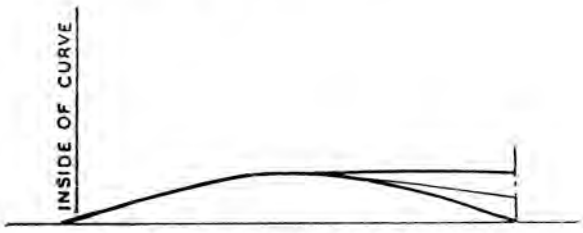


FIG. 11 (b) OUTER HALF RAISED LEVEL

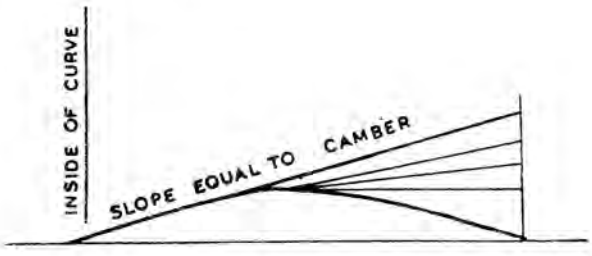


Fig. 11 (c). Superelevation equal to camber

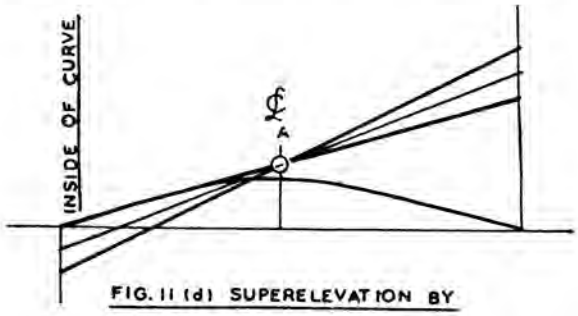


FIG. 11 (d) SUPERELEVATION BY ROTATION ABOUT CENTRAL LINE

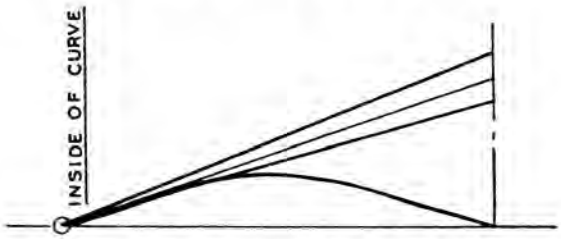


FIG. 11 (e) SUPERELEVATION BY ROTATION ABOUT THE INNER EDGE

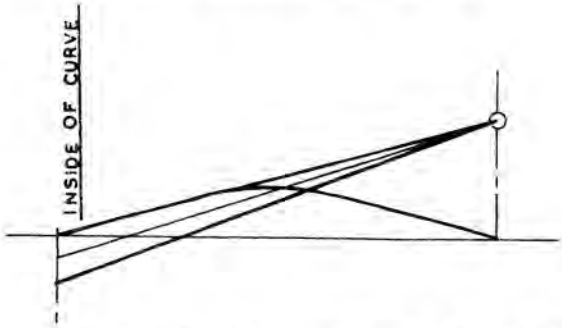


Fig. 11 (f). Superelevation by rotation about the outer edge

In the second stage one of the following two methods may be adopted depending upon site conditions :

(1) The surface of the road is rotated about the point A, Fig. 11 (d) lowering the inner edge and raising the outer edge. In this case, the level of the centre line of the road remains practically unchanged.

(2) The surface of the road is rotated about the inner edge. This will raise the centre and outer edge simultaneously and will result in the increase of the height of the embankment on outer portion of the curve.

When rotation is about the center line in certain site conditions, the reduction in level of the inner edge may cause a valley which is difficult to drain. In locations such as approaches to an overbridge, rotation about the center line of the road will cause a reduction in the level of the inner half, thus reducing the required clearances. In such cases, the level of the inner edge may be kept constant and the outer edge raised. In some locations it may be necessary to attain superelevation keeping the level of the outer edge constant. In such cases the camber is first eliminated and the surface rotated about the outer edge, Fig. 11 (f). The above facts show that the method adopted should be decided in individual cases to suit local conditions. Fig. 11 shows the various stages of attaining superelevation from the normal cambered surface to full superelevation.

5.4.2. When superelevation is applied according to the formula $\frac{V^2}{225\,R}$ it is seen that the maximum permissible superelevation of 7 per cent is obtained when the radius of the curve is equal to $0.06349\,V^2$ whereas the minimum radius permissible for any design speed is $0.0358\,V^2$. Therefore, for curves whose radii lie between $0.06349\,V^2$ and $0.0358\,V^2$, the maximum superelevation is attained at a point on the transition curve where the radius is equal to $0.06349\,V^2$. This involves calculation and marking of the point on the transition curve where radius is equal to $0.06349\,V^2$ in the field and providing superelevation with zero at the start of the curve and 7 per cent at this point B in Fig. 12 Case (i) on the other hand, when superelevation is so built in that its full value is attained at the end of the transition, AC in Fig. 12 field work is simplified, case (ii).

The effect of obtaining the superelevation by the two methods mentioned above is discussed below. Assuming that the majorty of the vehicles travel at $\frac{3}{4}$th of the design speeds in case (i), friction will not be called upon to play from the start of the curve. It will develop from zero at B to 0.15 at C, Fig. 12. In case (ii) friction will develop from zero at A to 0.15 at C. It can be seen that there is no definite advantage in giving superelevation according to case (i). On the other hand, the field set out is little complicated. Therefore, superelevation should be uniformly increased from zero at the start of the curve to its full designed value at the end of the transition.

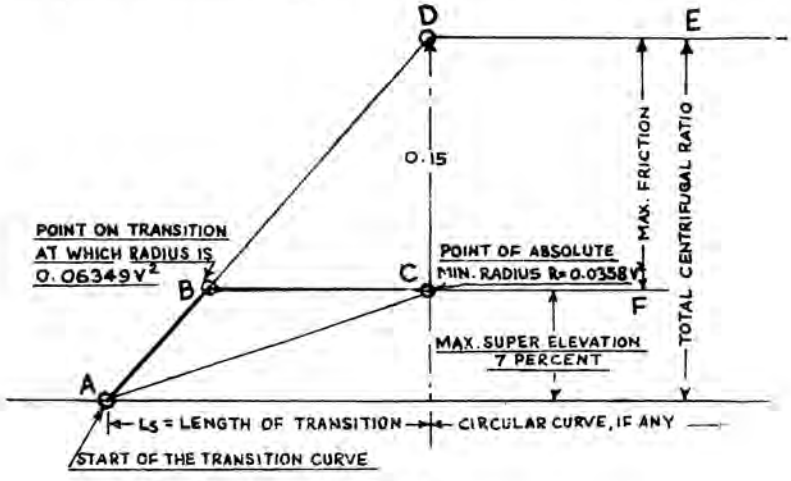


Fig. 12

When building superelevation, it is seen that abrupt changes in grade will be introduced in longitudinal profile. These should be rounded off or smooth riding and to avoid unsightly appearance by short vertical curves. The vertical curves should be at least 15 m in length.

Profiles showing the three methods of attaining superelevation are shown in Fig. 13.

Example 11.1 illustrates a design of superelevation.

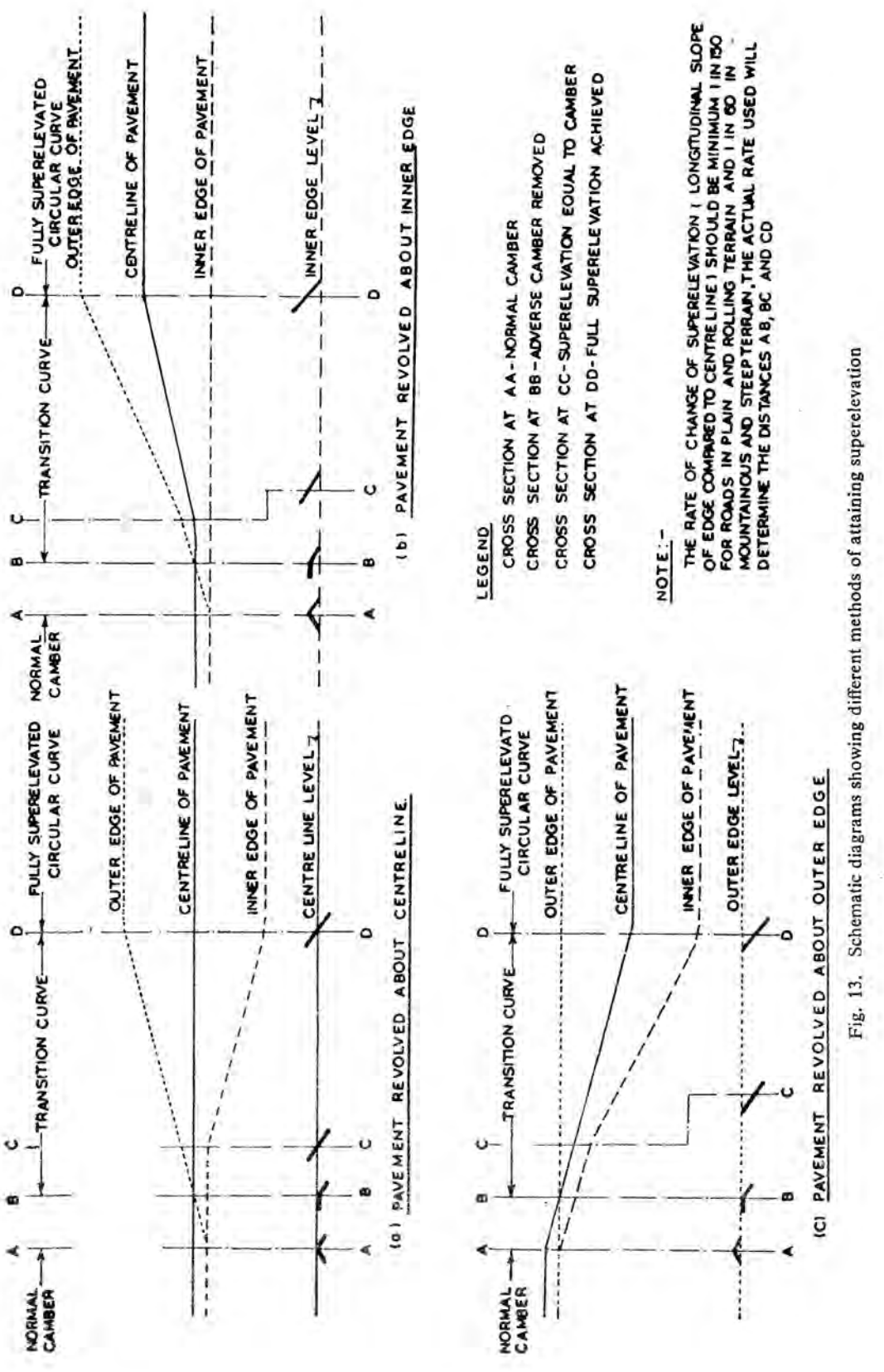


Fig. 13. Schematic diagrams showing different methods of attaining superelevation

6. WIDENING PAVEMENTS ON CURVES

6.1. Necessity

6.1.1. When vehicles negotiate a curve, the rear wheels generally do not follow the same track as that of the front wheels. When the curve is not superelevated the rear wheels track inside the front wheels. On superelevated curves, the relative position of the wheel tracks depends upon the speed and consequently upon the amount of friction developed for equilibrium. The greater the speed the rear wheels assume a position farther out. So with excessive speeds the rear wheels may track outside the front wheels. Therefore widening of the pavement is necessary to provide for this change in the overall track width required for travel at various speeds.

6.1.2. On curves, the drivers have difficulty in steering their vehicles to keep to the central line of the road and are not able to keep to the outer edge of the road as they are able to on the straight. Also when passing vehicles on curves, the psychological tendency is to drive at greater clearances than on the straights. The front overhang of the vehicle reduces the clearances when passing or overtaking other vehicles on curves.

6.1.3. When truck-trailer combinations travel at speeds for which superelevation fully counteracts the centrifugal force, the rear wheels of the trailer track inside the rear wheels of the tractor. Extra widening is required for accommodation of this. At greater speeds the trailer track farther out. At excessive speeds the longitudinal axis of the driving vehicles and the trailer may form a bend opposite in direction to the curve of the road. Rough pavements or jerks on the towbar tend to whip the trailer from the central position of the lane. So extra width is necessary on curves for the safe operation of vehicles.

6.2. Amount of Widening

6.2.1. **Mechanical widening** : Fig. 14 shows diagramatically the extra width required when a vehicle negotiates a curve. If l is the wheel base and R the radius of the curve, the extra width occupied by the vehicle, viz. AB in figure is equal to $\frac{l^2}{2R}$ for large values of R compared to l. Assuming a vehicle with a wheel base of 11 m as a representative one, $AB = \frac{121}{2R}$ is the extra

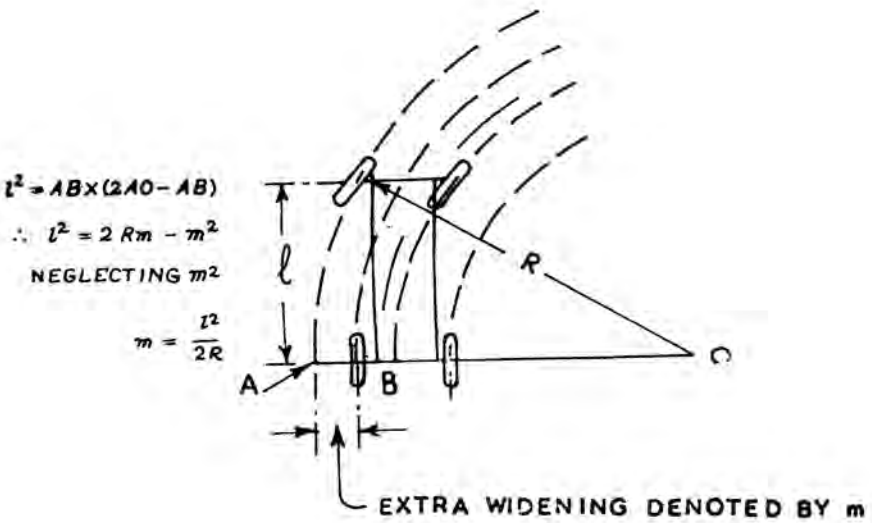


Fig. 14

width of pavement required for the vehicle to traverse the curve. This is called Mechanical Widening.

6.2.2. **Psychological wideing :** When vehicles pass or overtake on curve clearances more than those when they negotiate a straight are required to provide for the curves traced by the overhand and psychological reasons. This is a function of the speed and is determined by the empirical formula $9.5 \frac{V}{\sqrt{R}}$. This may be called the psychological widening, thus making provision for the mechanical widening required because of the rigid body of the vehicle and phychological widening, the formula for extra width on curves is given by

$$W_e = \frac{l^2}{2R} + \frac{V}{9.5\sqrt{R}} \quad \ldots (8)$$

6.2.3. On two-lane or wider roads it is necessary that both the above components should be fully catered for so that the lateral clearance between vehicles on curves is maintained equal to the clearance available on straights. Position of single-lane roads however is somewhat different, since during crossing manoeuvres outer wheels of vehicles have in any case to use the shoulders whether on the straight or on the curve. It is therefore sufficient on single-lane roads if only the mechanical component of widening is taken into account.

6.2.4. Based on the above considerations, the extra width of carriageway to be provided at horizontal curves on single and two-lane roads is given in Table 7. For multi-lane roads, the pavement widening may be calculated by adding half the widening for two-lane roads to each lane.

TABLE 7. EXTRA WIDTH OF PAVEMENT AT HORIZONTAL CURVES

Radius of curve (m) Extra width (m)	Up to 20	21 to 40	41 to 60	61 to 100	101 to 300
Two-lane	1.5	1.5	1.2	0.9	0.6
Single-lane	0.9	0.6	0.6	Nil	Nil

6.2.5. The widening should be effected by increasing the width at an approximately uniform rate along the transition curve. The extra width should be continued over the full length of the circular curve. On curves having no transition, widening should be achieved in the same way as the superelevation i.e. two-third being attained on the straight section before start of the curve and one-third on the curve.

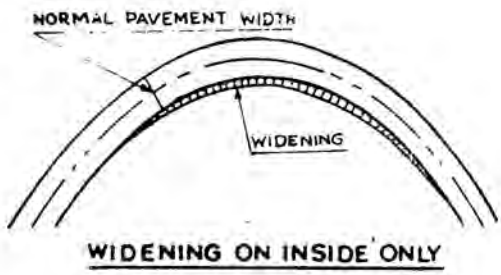
6.2.6. The widening should be applied equally on both sides of the carriageway, except that on hill roads it will be preferable the entire widening is done only on the inside. Similarly, the widening should be provided only on the inside when the curve is plain circular and has no transition.

6.2.7. The extra widening may be attained by means of offsets radial to the centre line. It should be ensured that the pavement edge lines are smooth and there is no apparent kink.

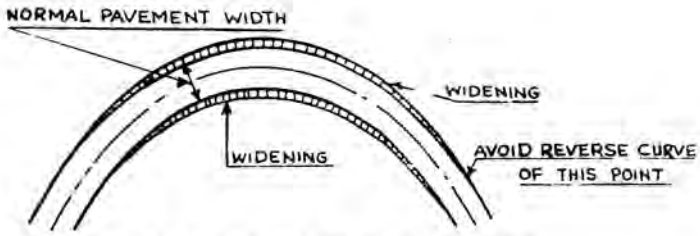
6.3. **Method of Widening**

6.3.1. Widening must be attained gradually to ensure a smooth alignment for the edge of the pavement. In two-lane pavements, the widening should be equally spread on both sides whereas in single-lane pavements, with sharp curves (less than 150 m) the pavement should be widened, on the inside of the curve. From the point of appearance and utility, widening the carriageway by having parallel transitions at the edges is ideal. This will result in graceful curves.

6.3.2. The widening (as in the case with superelevation) should be gradually built in from the start of the curve (T.P.) to attain the designed value at the end of the transition curve. This designed value should be continued throughout the circular curve, Fig. 15.



WIDENING ON INSIDE ONLY



WIDENING ON INSIDE AND OUTSIDE

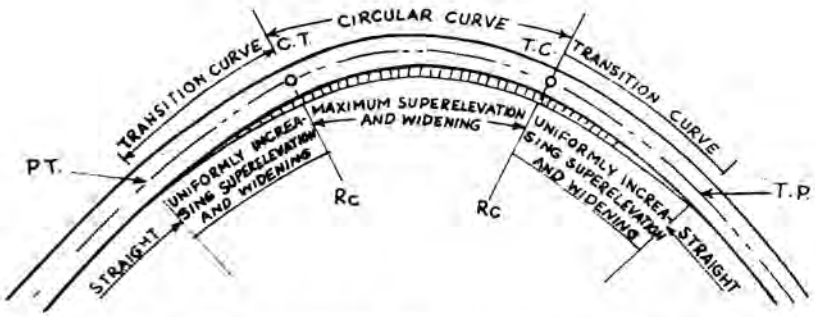


Fig. 15. Methods of effecting widening and building in superelevation

6.3.3. The following are the possible methods of widening a road curve :

(1) By distributing the extra widening required proportionate to the distance from the start of the curve
 (a) when the widening is entirely on the inside;
 (b) when the widening is distributed equally on both sides of the central line.

(2) By providing for the edges of the pavement circular curves equal in radius to that of the central line and transitions equal in length to that of the central line.

(3) When the edges of the pavement are true spirals of suitable transition lengths but the circular curve portion at the inner and outer edges are not concentric and have different radii.

(4) Where edges of the pavement are true spirals and the circular curve portions of the outer and the inner edges are concentric with that of the central line.

6.3.4. The central line is first laid and the extra widening is built in by means of offsets radial to the central line proportional to the distance from the start of the curve. If the widening is desired entirely on the inside the extra offsets will be to the inside of the curve. If the widening is to be equally distributed on both sides, the total width at any distance is distributed on either side

of the central line. When the widening is distributed on both sides a slight kink will result in the outer edge of the pavement near the start of the curve. This should be avoided by extending the outer edge of the pavement on the straight up to the point where the curve falls inside it, Fig. 16. Examples in example 11.29 illustrate the method.

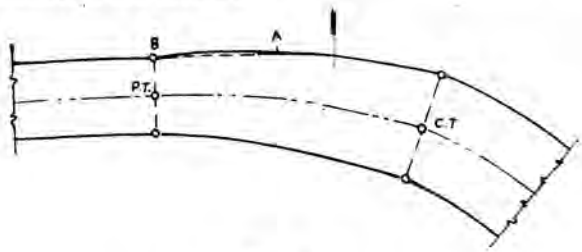


Fig. 16

In practice, adopting true spirals for the edges of the pavement involves, laborious calculations. The method of proportional widening in effect, gives a transition for the edges of the pavement even though they may not be true spirals. It is recommended that this method be followed.

6.3.5. When circular curves equal in radius to that of the central line and transitions equal in length to that of the central line are adopted for the edges of the pavement, the widening that will result is equal to the width of the pavement of the straight multiplied by sec. $\frac{\Delta}{2}$. This may be more or less, than the widening required for the curve. Even though this is ideal from the standpoint of operation of the vehicle in that the radii of curves and the transitions at all points on the curve are same, the widening that will result may be unsatisfactory. The example in Example 11.30 illustrates the calculations necessary.

6.3.6. According to the method described in para 6.4.5. widening secured is always equal to $W \times$ sec. $\frac{\Delta}{2}$. Therefore, the amount of extra widening depends on the value of the deviation angle. In most cases it may be more or less the value required.

Table 9 shows the automatic widening secured when transition length and radii of curves for the edges of the pavement are the same as for the central line for different values of deviation angle. When the value of Δ exceeds the value given in Table 7A, the automatic widening will be more than the corresponding value for widening shown in the table. When Δ is less than the value in Table 7A, the automatic widening will be less than the corresponding figure. This table can be used to find out if the required widening can be secured or not by using curves of the same radius and spirals of the same length as that of the central line.

TABLE 7 A. RELATIONSHIP OF WIDENING AND DEVIATION ANGLE

Widening in m		Deviation angle
0.30	...	33°—55′
0.60	...	47°—08′
0.90	...	56°—44′
1.20	...	64°—24′
1.50	...	70°—51′

The exact amount of widening required can be secured by employing curves of differing radii and differing transition lengths for the edges of the pavement. Example 11.31 illustrates the method.

6.3.7. It can be observed that in the layout worked in para 6.3.5. and 6.3.6. the extra widening increases from zero to the required value at the mid-point of the circular curve. But the design requirements stipulate that the maximum extra widening be attained at start of the circular curve. So the widening along the circular curve will fall short of requirements. The ideal would be to have concentric circular curves and suitable transition lengths the required widening being attained at the start of the curve. Example 11.32 illustrates the calculations necessary for a concentric layout.

6.4. **Set-back Distance at Horizontal Curves**

6.4.1. Requisite sight distance should be available across the inside of horizontal curves. Lack of visibility in the lateral direction may arise due to obstructions like walls, cut slopes, buildings, wooded areas, high farm crops etc. Distance from the road centre line within which the obstructions should be cleared to ensure the needed visibility i.e. the "set-back distance" can be calculated vide procedure described in para 6.4.2. But in certain cases, due to variations in alignment, road cross-section, and the type and location of obstructions, it may become necessary to resort to field measurements to determine the limits of clearance.

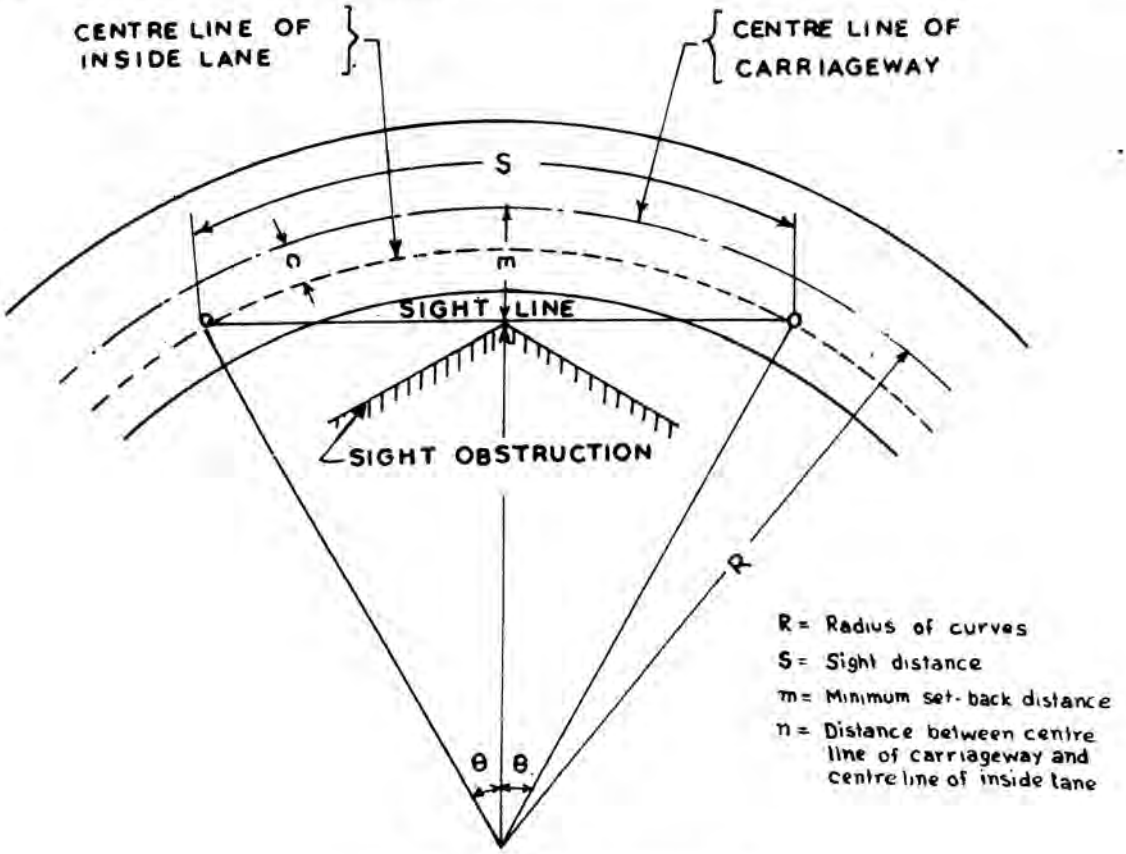


Fig. 17. Visibility at horizontal curves

6.4.2. The set-back distance is calculated from the following equation (see Fig. 17 for definitions) :

$$m = R-(R-n)\ Cos\ \theta \qquad \ldots\ (14)$$

$$\text{where } \theta = \frac{S}{2\,(R-n)} \text{ radians} \qquad \ldots\ (15)$$

m = the minimum set-back distance to sight obstruction in metres (measured from the centre line of the road);

R = radius at centre line of the road in metres;

n = distance between the centre line of the road and the centre line of the inside lane in metres; and

S = sight distance in metres.

In the above equation, sight distance is measured along the middle of inner lane. On single-lane roads, sight distance is measured along centre line of the road and 'n' is taken as zero.

6.4.3. Based on the above equation, design charts for set-back distance corresponding to the safe stopping sight distance are given in Figs. 18 and 19 and Table 8. Values in Table 8 relate basically to circular curves longer than the design sight distance. For shorter curves, the values of set-back distance given in Table 8 will be somewhat on the higher side, but these can any way be used as a guide. Lateral clearances for two lane carriageway can be computed similarly from the above equation.

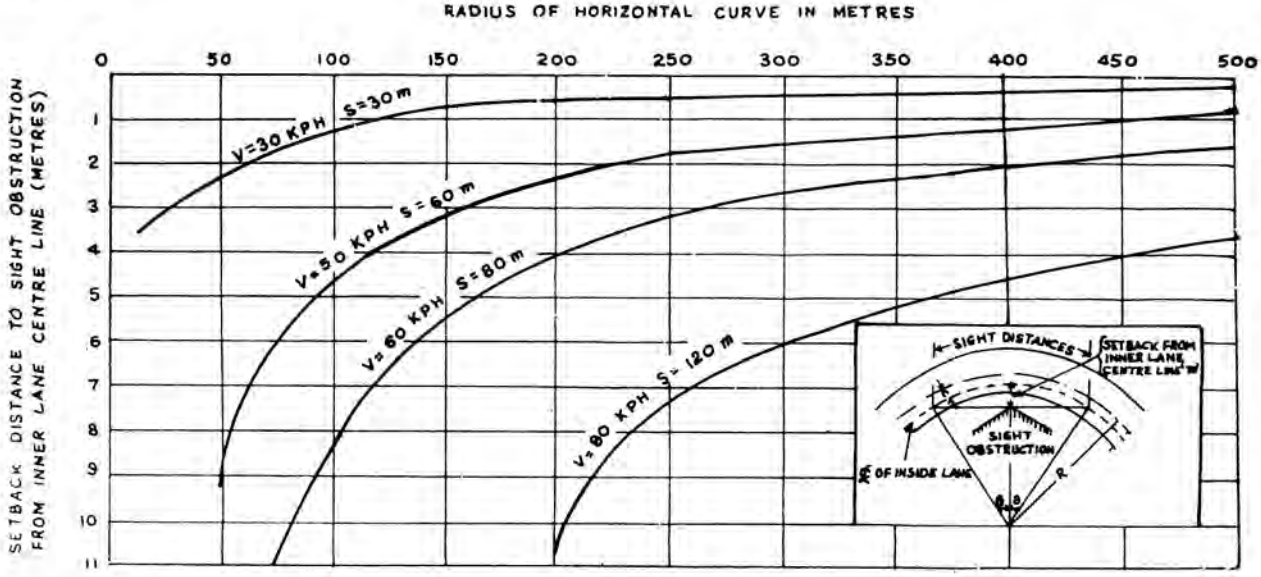


Fig. 18. Minimum set-back distance required at horizontal curves on two lane urban roads for safe stopping sight distance

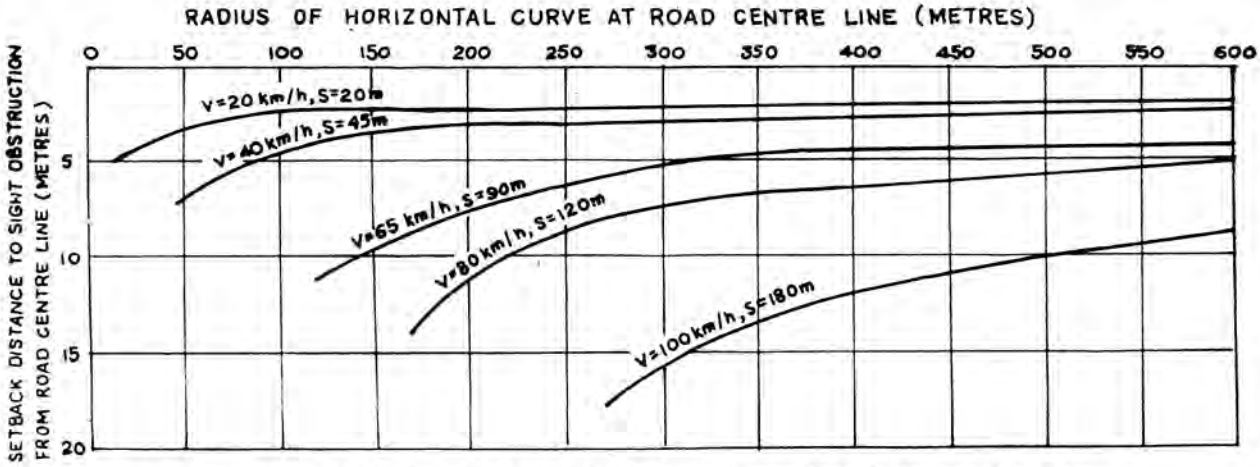


Fig. 19. Minimum set-back distance required at horizontal curve for safe stopping sight distance

6.4.4. Set-back distance for overtaking or intermediate sight distance can be computed similarly but the clearance required is usually too large to be economically feasible except on very flat curves.

6.4.5. When there is a cut slope on the inside of the horizontal curve, the average height of sight line can be used as an approximation for deciding the extent of clearance. For stopping sight distance, which is the bare minimum requirement for design, the average height may be taken as 0.7 m. Cut slopes should be kept lower than this height at the line demarcating the set-back distance envelope, either by cutting back the slope or benching suitably. In the case of intermediate or overtaking sight distance, height of sight line above the ground should be taken as 1.2 m.

6.4.6. Where horizontal and summit vertical curves overlap, the design should provide for the required sight distance both in the vertical direction along the pavement and in the horizontal direction on the inside of the curve.

TABLE 8. RECOMMENDED SET-BACK DISTANCES FOR SINGLE-LANE CARRIAGEWAY IN HILL ROADS

Radius of circular curve in metres	Set-back distance in metres				
	S = 20 m (V = 20 km/h)	S = 25 m (V = 25 km/h)	S = 30 m (V = 30 km/h)	S = 45 m (V = 40 km/h)	S = 60 m (V = 50 km/h)
14	3.4	—	—	—	—
15	3.2	—	—	—	—
20	2.4	3.8	—	—	—
23	2.1	3.3	—	—	—
30	1.7	2.6	3.7	—	—
33	1.5	2.3	3.7	—	—
50	1.0	1.6	2.2	5.0	—
60	—	1.3	1.9	4.2	—
80	—	1.0	1.4	3.1	5.6
100	—	0.8	1.1	2.5	4.5
120	—	0.7	0.9	2.1	3.7
150	—	0.5	0.8	1.7	2.3

7. TRANSITION CURVE

7.1. Necessity for the Transition Curve

7.1.1. When a vehicle travels from the straight to a curve of finite radius, it is suddenly subjected to an outward centrifugal force. This causes a shock and sway to the passenger and the driver. In practice, the driver on or before entering a curve will turn the steering gradually for his own comfort and security. This gradual turning of the steering produces a sort of transition. When the steering is turned at a fast rate, there is a tendency to cut the corner and encroach on the adjoining traffic lane creating a hazard. If the transition is made within the traffic lane, it has to be very short requiring strain on the driver. The smaller the difference in width between the traffic lane and the widest vehicle, the shorter will be the transition that will have to be made within the limits of the lane. Modern goods and public passenger transport buses are as wide as 2.5 m. So very short transition would have to be made if the vehicles are not to encroach on the adjoining lane.

7.1.2. The methods of minimising the shock caused by the effects of the sudden application of the centrifugal force and reducing hazards are :

(1) Reduction in speed of the vehicle,
(2) Taking a new path with a greater radius of curve,
(3) Combination of (1) and (2) and
(4) Designing the alignment with a radius of curvature gradually changing from infinity to the designed radius.

Reducing the speed can be done only if the driver has a prior knowledge of the curve and its radius (though approximate) so that he can adjust his speed suitably. Reduction and increase in speed at every curve is not conducive to free flow of traffic. Taking a new path with a greater radius of curve would necessarily involve an encroachment into the inner lane. It will therefore be hazardous. The fourth method in which a curve of gradually changing radius is built into the road alignment, permits the same speed on the curves as on the straights. Since the centrifugal ratio is developed gradually, the passengers and the driver are not subjected to shock.

7.1.3. Besides enabling the driver to turn steering wheel gradually, the transition permits the gradual application of the superelevation necessary for the safe-driving. In addition, transition curves improve the aesthetic appearance of the road. When a circular curve joins a straight, an optical illusion of a bulge is generally produced. On the other hand, if transitions are introduced, this deceptive appearance will be eliminated.

7.2. Types of Transition

7.2.1. **Essential requirement of transition curves :** The essential requirements of a transition curve are :

(1) Radius of curvature should decrease gradually from infinity to the minimum to enable the steering wheel to be turned gradually and to eliminate the shock due to application of centrifugal force.

(2) The rate of change of centrifugal acceleration, i.e., C should be such as not to cause discomfort or undesirable oscillation. Since the radial acceleration is inversely proportional to the radius of curvature for any fixed speed, the transition should be such that the radius of curvature should be inversely proportional to the length of the curve from the starting point.

The spiral satisfies these requirements.

7.2.2. **The lemniscate :** In a lemniscate which is also used as a transition curve, the radius of curvature does not decrease directly with the length of the curve, thus there is a slight falling off in the rate of gain of centrifugal acceleration of vehicles using it as the distance from the start of the curve increases. For deflections greater than 30° the rate of change of radius decreases and is not uniform.

7.2.3. **The cubic parabola :** The cubic parabola is also suitable for transition but this curve

has no transitional properties for polar deflection angles of greater than 9°. Thus it is not considered suitable for road curves where the deflection angles are large.

7.2.4. **Spiral :** Considering the theoretical requirements and facility of setting out in the field, the spiral is specified for use as transition curves for roads in India. It satisfied ideally the requirements of a transition, viz., that the radius of curvature is inversely proportional to the length of the travel and, therefore, the rate of change of acceleration is uniform through the length of the transition. It has geometric properties which permit shifting of the instrument in case it is necessary in field set-out. The rate of change of centrifugal acceleration can be regulated to be within the limits of comfort by choosing a suitable length for the transition.

7.3. **Minimum Length of Transition**

7.3.1. Length of transition should be the greater of the two values derived from considerations of

(1) rate of change of centrifugal acceleration
and
(2) rate of change of superelevation

7.3.2. **Rate of change of centrifugal acceleration :** The rate of change of centrifugal acceleration should not cause discomfort to drivers. From this consideration, the length of transition curve is given by :

$$L_s = \frac{0.0215\ V^3}{CR} \qquad \ldots (16)$$

where

L_s = length of transition in metres
V = speed in km/h
R = radius of circular curve in metres

$$C = \frac{80}{75 + V} \text{ (subject to a maximum of 0.8 and minimum of 0.5)} \qquad \ldots (17)$$

7.3.3. Rate of change of superelevation or run off. The rate of change of superelevation (i.e. the longitudinal grade developed at the pavement edge compared to through grade along the centre line) should be such as not to cause discomfort to travellers or to make the road appear unsightly. Rate of change should not be steeper than 0.66 per cent (1 in 150) for roads in plain and rolling terrain, and 1.66 per cent (1 in 60) in mountainous/steep terrain.

Taking a two-lane road in plain/rolling terrain and assuming a pavement widening of 0.9 m, the height of the outer edge of the carriageway will be $\frac{7.9}{2} \times \frac{7}{100}$ m above the centre line. To attain this height with a longitudinal slope of 0.66 per cent (1 in 150), a length of 42 m is required.

The spiral curve has the property RL = constant. The radius of the curve at the end of the transition L_s equals R_c. The radius of curve at the point where maximum superelevation is obtained is $0.0635V^2$ and the length of the spiral upto this point has to be 42 m. Thus the length of the transition L_s that is required from considerations of rate of change of superelevation 0.66 percent (1 in 150) is :

$$L_s = \frac{42 \times 0.0635V^2}{R_c} = \frac{2.67V^2}{R_c}$$

$$\text{or} = \frac{2.7V^2}{R_c} \qquad \ldots (18)$$

For hill roads (mountainous/steep terrain), with the rate of change of superelevation of 1.66 per cent (1 in 60), the equation for L_s will be

$$L_s = \frac{1.0\ V^2}{R_c} \qquad \ldots (19)$$

With the recommended method of distributing the superelevation over the full length of the transition curve (see para 5.4.2), the lengths derived from equations (18) and (19) will be some what conservative for curves whose radii is between 0.0635 V^2 and 0.0358 V^2.

Equations (18) and (19) have been derived for two-lane roads, but these can be applied equally to single lane roads and 4-lane divided highways. For 4-lane undivided and 6-lane divided highways, it would be preferable to increase the lengths given by these equations by 50 per cent.

7.3.4. Having regard to the considerations given in para 7.3.1., the minimum transition lengths for different speeds and curve radii are given in Table 9. This Table also indicates the radii

TABLE 9. MINIMUM TRANSITION LENGTHS FOR DIFFERENT SPEED AND CURVE RADII

Curve Radius (Rc) (metres)	Transition Lengths (Metres)																		Curve Radius (Rc) (metres)
	100 km/h		80 km/h		65 km/h		50 km/h		40 km/h		35 km/h		30 km/h		25 km/h		20 km/h		
	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	P	H	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
14																	80	30	14
15																NA	75	30	15
20															NA	35	55	20	20
23															75	—	—	—	23
25													NA	NA	70	25	45	20	25
30												NA	80	30	60	25	40	15	30
33												—	75	—	—	—	—	—	33
40											NA	35	60	25	45	20	30	15	40
45										NA	75	30	55	20	40	15	25	15	45
50										40	70	25	50	20	35	15	25	15	50
55									NA	40	60	25	45	20	30	15	20	15	55
60									75	35	55	25	40	15	30	15	20	15	60
70								NA	65	30	50	20	35	15	30	15	15	15	70
80							NA	55	55	25	45	20	30	15	25	15	15	15	80
90							75	45	50	25	40	15	30	15	20	15	15	NR	90
100							70	45	45	20	35	15	25	15	20	15	NR		100
125					NA		55	35	35	15	30	15	20	15	15	NR	—		125
155					80		—	—	—	—	—	—	—	—	—				155
150					80		45	30	30	15	25	15	20	15	15	—			150
170					70		40	25	25	15	20	15	15	NR	NR	—			170
200			NA		60		35	20	25	15	20	15	15						200
230			90		—		—	—	—	—	—	—	—						230
250			90		50		30	15	20	15	NR	NR	NR						250
300	NA		75		40		25	15	NR	NR	—								300
350	130		60		35		20	—		—	—								350
360	130		—		—		—	—	—	—	—								360
400	115		55		30		20	15											400
500	95		45		25		NR	NR											500
600	80		35		20														600
700	70		35		20														700
800	60		30		NR														800
900	55		30																900
1000	50		30																1000
1200	40		NR																1200
1500	35																		1500
1800	30																		1800
2000	NR																		2000

SPEED NOT APPLICABLE

SPEED NOT APPLICABLE

SPEED NOT APPLICABLE

NOTATIONS :

P = PLAIN AND ROLLING TERRAIN
H = MOUNTAINOUS AND STEEP TERRAIN
NA = RADIUS NOT APPLICABLE
NR = TRANSITION NOT REQUIRED

beyond which no transition is required. From practical consideration, it is a good plan to take L_s as a whole multiple of 5 m, if 5 m is to be the length of Standard chord used for setting out, this whole number of chords giving lengths somewhat greater than the theoretical minimum length.

7.4. Radii Beyond which no Transition is Required

7.4.1. When vehicles negotiate a curve, centrifugal ratio developed is inversely proportional to the radius of the curve. So for curves of large radii the centrifugal force developed is small. For a curve of 1200 m radius, on a National Highway, the design speed for which is 80 kmph, the centrifugal ratio that will be developed is equal to 0.042. Therefore, sudden entry of a vehicle from the straight into the curve is not likely to cause a shock to the passengers because of the small amount of centrifugal force. Also when no transitions are provided, the driver turns the steering wheel gradually and in effect, makes his own transition. For a radius of 1200 m for vehicle travelling at 80 kmph, the minimum transition length that is required is 14.4 m. The distance or the shift that will be necessary to make this transition is 0.043 m. This distance is so small that when traffic lanes of 3.5 m are adopted, the drivers will have no difficulty in remaining within the lane width and yet make the transition.

7.4.2. When a vehicle negotiates a 1200 m radius curve on the inside which has a camber of say 1.7 per cent, the friction that will be developed is 0.042—0.017 = 0.025. This is within the permissible limit. When a vehicle uses outside of the curve, friction developed is 0.042 + 0.017 = 0.059. This is also within the permissible limit.

7.4.3. The above mentioned considerations show that curves having a radius of more than 1200 m need not necessarily be provided with transitions. They may, however, be used if required for graceful alignment.

7.5. The Spiral

7.5.1. In general, horizontal curves should consist of either a circular curve flanked by spiral transitions at both ends or two transition spiral curves connected to each other. Spiral curves are recommended for transition.

7.5.2. **Properties of simple spiral :** A transition curve joins the tangent and the circular curve (as two circular curves of substantially different radii). Ideal transition curve is a spiral, which has the property that product of the length of spiral (from the starting point to any point on it) and the radius of curvation of the point under consideration is constant, i.e.

$$LR = L_s R_c = \text{constant } (A^2)$$

$$\text{now } \frac{1}{R} = \frac{d\theta}{dL}, \text{ the curvature}$$

where θ is the spiral deflection angle

$$\therefore \frac{L}{R_c L_s} = \frac{d\theta}{dL}$$

$$\text{or } d\theta = \frac{L.dL}{R_c L_s} \qquad \ldots (20)$$

and integrating,

$$\theta = \frac{L^2}{2R_c L_s} + K$$

Where $L = 0$, $\theta = 0$

$K = 0$

so that θ (Radian) $= \frac{L^2}{2R_cL_s}$ (the intrinsic equation for the spiral) .. (21A)

and θ_s (spiral angle) *in* radian $= \frac{L_s}{2R_c}$

θs (in degrees) $= \frac{28.65 \times L_s}{R_c}$... (21B)

For purpose of setting out this curve by offsets from tangent at the origin, the cartesian co-ordinates, referred to the tangent as x-axis would require to be calculated and may be obtained as follows :

$$\frac{dy}{dL} = \text{Sin}\theta = \left(\theta - \frac{\theta 3}{3!} + \frac{\theta 5}{5!} - \frac{\theta 7}{7!} \ldots\ldots\ldots\right)$$

but from equation (20), $dL = \frac{R_c.L_s.d\theta}{L}$ and

eliminating L, with equation (21A)

$$dL = \frac{R_cL_s\, d\theta}{\sqrt{2R_cL_s\,\theta}} = \frac{\sqrt{2R_cL_s}\, d\theta}{2\sqrt{\theta}}$$

$$\therefore dy = \frac{\sqrt{2R_cL_s}}{2}\left(\theta^{1/2} - \frac{\theta^{5/2}}{3!} + \frac{\theta^{9/2}}{5!} - \frac{\theta^{13/2}}{7!} + \ldots\ldots\ldots\right)$$

by integrating which

$$y = \sqrt{2R_cL_s}\left(\frac{\theta^{3/2}}{3} - \frac{\theta^{7/2}}{7.3!} + \frac{\theta^{11/2}}{11.5!} - \frac{\theta^{15/2}}{15.7!} + \ldots\ldots\ldots\right)$$

since from equation (21A) $\sqrt{2R_cL_s} = \frac{L}{\theta^{1/2}}$

$$\therefore y = L\left(\frac{\theta}{3} - \frac{\theta^3}{7.3!} + \frac{\theta^5}{11.5!} - \frac{\theta^7}{15.7!} + \ldots\ldots\ldots\right)$$

$$y = L\left(\frac{\theta}{3} - \frac{\theta^3}{42} + \frac{\theta^5}{1320} - \frac{\theta^7}{75600} + \ldots\ldots\ldots\right) \quad \ldots (22)$$

since from equation (21A), $\theta = \frac{L^2}{2R_cL_s}$

$$y = \frac{L^3}{3(3R_cL_s)} - \frac{L^7}{7.3!\ (2R_cL_s)^3} + \frac{L^{11}}{11.5!\ (2R_cL_s)^5} - \frac{L^{15}}{15.7!\ (2R_cL_s)^7} + \ldots\ldots\ldots$$

$$Y = \frac{L^3}{6R_cL_s} - \frac{L^7}{336R_c^3L_s^3} + \frac{L^{11}}{42240R_c^5L_s^5} - \frac{L^{15}}{9676800R_c^7L_s^7} + \ldots\ldots\ldots$$

similarly

$$\frac{dx}{dL} = \text{Cos}\,\theta = \left(1 - \frac{\theta^2}{2!} + \frac{\theta^4}{4!} - \frac{\theta^6}{6!} + \ldots\ldots\ldots\right)$$

$$x = \sqrt{2 R_c L_s}\left(\theta^{\frac{1}{2}} - \frac{\theta^{5/2}}{5.2!} + \frac{\theta^{9/2}}{9.4!} - \frac{\theta^{13/2}}{13.6!} + \ldots\ldots\ldots\ldots \right),$$

$$x = L \left(1 - \frac{\theta^2}{5.2!} + \frac{\theta^4}{9.4!} - \frac{\theta^6}{13.6!} + \ldots\ldots\ldots\ldots \right),$$

$$x = L\left(1 - \frac{\theta^2}{10} + \frac{\theta^4}{216} - \frac{\theta^6}{9360} + \ldots\ldots\ldots\ldots\right) \quad \ldots (23)$$

$$x = L - \frac{L^5}{5.2!\,(2 R_c L_s)^2} + \frac{L^9}{9.4!\,(2 R_c L_s)^4} - \frac{L^{13}}{13.6!\,(2 R_c L_s)^6} + \ldots\ldots\ldots\ldots$$

The series rapidly converges, since in practical case, θ never exceeds a small fraction of a radian. The x coordinate is of minor importance, since the offset y could be employed in conjunction with length 'L' along the curve the setting out being performed by chords and offsets.

Where method of deflection angles and chords from starting point are used, the deflection angle from tangent point to a point 'L' along curve can be calculated as below :

$$\tan \alpha = \frac{y}{x} = \frac{\frac{\theta^{3/2}}{3} - \frac{\theta^{7/2}}{7.3!} + \frac{\theta^{11/2}}{11.5!} + \ldots\ldots\ldots\ldots}{\theta^{1/2} - \frac{\theta^{5/2}}{5.2.!} + \frac{\theta^{9/2}}{9.4!} + \ldots\ldots\ldots\ldots}$$

$$= \frac{\theta}{3} + \frac{\theta^3}{3.5.7} + \frac{26\,\theta^5}{3^4.5^2.7.11} - \frac{17\,\theta^7}{3^3.5^3.7.11.13} + \ldots\ldots\ldots\ldots$$

$$\approx \frac{\theta}{3} + \frac{\theta^3}{105} + \frac{\theta^5}{5997} - \frac{\theta^7}{198700}$$

$$\text{Now } \alpha = \tan \alpha - \frac{1}{3}\tan^3 \alpha + \frac{1}{5}\tan^5 \alpha - \frac{1}{7}\tan^7 \alpha + \ldots\ldots\ldots\ldots$$

$$\therefore \alpha = \frac{\theta}{3} - \frac{2^3.\theta^3}{3^4.5.7.} - \frac{2^5.\theta^5}{3^5.5^2.7.11} - \frac{23.2^7.\theta^7}{3^7.5^3.7^2.11.13} + \ldots\ldots\ldots\ldots$$

$$= \frac{\theta}{3} - \frac{8\,\theta^3}{2{,}835} - \frac{32\,\theta^4}{467{,}775} - \frac{2944\,\theta^7}{1{,}915{,}538{,}625} \quad \ldots (24)$$

By approximation

$$\alpha \approx \frac{\theta}{3} \approx \frac{L^2}{6 R_c L_s}$$

7.5.3. **Relationship between transition and main curves :** In order to fit in equal transitions between ends of a circular curve of predetermined radius, it is usual to move the centre of the circular curve away from the point of intersection of the straight tangents along the line bisecting the angle of intersection of these tangents (refer Figs. 2 & 3). This means moving the tangents parallel to the older by almost equal to the shift 's'. In Fig. 2,

$$\text{Tangent Distance } Ts = K + (R_c + s) \tan \frac{\Delta}{2}; \quad \ldots (25)$$

$$\text{Apex Distance } Es = (R_c + s) \sec \frac{\Delta}{2} - R_c; \quad \ldots (26)$$

Shift, $s = y - R_c$ versin θ ; and

$$K = x - R \sin \theta$$

$$\therefore s = \tfrac{1}{2} L_s \left(\frac{\theta}{3.2!} - \frac{\theta^3}{7.4!} + \frac{\theta^5}{11.6!} - \frac{\theta^7}{15.8!} + \ldots\ldots \right)$$

$$K = \tfrac{1}{2} L_s \left(1 - \frac{\theta^2}{5.3!} + \frac{\theta^4}{9.5!} - \frac{\theta^6}{13.7!} + \frac{\theta^8}{17.9!} + \ldots\ldots \right)$$

$$\therefore s = L_s \left(\frac{\theta}{12} - \frac{\theta^3}{336} + \frac{\theta^5}{15{,}840} - \frac{\theta^7}{1{,}209{,}600} + \ldots\ldots \right) \quad \ldots (27)$$

$$K = L_s \left[\tfrac{1}{2} - \frac{\theta^2}{60} + \frac{\theta^4}{2160} - \frac{\theta^6}{131{,}040} + \frac{\theta^8}{12{,}377{,}920} + \ldots\ldots \right] R_c \quad \ldots (28)$$

$$ST = (Rc + s) \text{ Cosec } \theta - R$$

$$= y \sec \theta$$

$$LT = K + (R + S) \tan\theta$$

$$= x + y \tan\theta$$

7.5.4. Other important properties of the spirals (refer Figs. 2 and 3) are given below for an understanding of its geometry:

(a) The product of the length of the spiral from the starting point to any point on the curve and the radius of curvature at the point under consideration is constant. Or in other words, the radius of curvature varies inversely as the distance of the curve from the start.

$$LR = L_s R_c = \text{Constant} = A^2 \text{ or}$$

$$R = \frac{\text{constant}}{L}; \; L = \frac{\text{constant}}{R}$$

(b) from the above mentioned relationship, the equation $L = M \sqrt{\theta}$ where M is constant and θ is in radians could be derived $M = \sqrt{2RL}$

(c) The tangent deflection angle θ at any point of the spiral varies as the square of the length of the spiral at that point from the start of the curve $\theta = \left(\frac{L}{L^s} \right)^2 \theta s$.

(d) The degree of the curve varies directly as its length

$$D = \frac{5730}{R} = 5730 \times \frac{L}{\text{constant}} = LK \text{ where } K \text{ is constant}$$

(e) For any one tangent deflection angle there are infinite number of combinations of the length of the curve and radius in $\theta_s = \frac{Ls \times 28.65}{Rc}$. For the same tangent deflection angle θ_s length of the spiral L_s increases directly as the radius R_c.

(f) For the same radius at the end of the spiral the tangent deflection angle increases directly as the length. The values of s, LC, LT, ST, etc., also increase.

(g) For the same length of the spiral as the radius of curve decreases, the tangent deflection angle increases; the elements of the spiral s, LT, ST, LC, X, Y also increase as the radius decreases.

(h) For the same value of the elements of the transition such as s, LC, LT, ST, K and X as the radius of curve increases, the length also increases but the tangent deflection angle of the spiral decreases.

7.5.5. The spiral deviates from its osculating circle at any point at the same rate as the spiral deviates from the tangent at the start of the curve. This property enables easy shift of the angular instrument wherever necessary in the set out of the curve in the field. The osculating circle and how it can be used for the shift of the instrument are explained in *Appendix 1.*

7.5.6. The following are approximate relations between the various elements of the curve of the spiral :

(1) For angles of deviation of less than 6° the offsets from the straight vary on as cube of the length of the spiral i.e., the spiral is the same as the cubic parabola.

(2) The Polar deflection angle $\propto$ at any point is one-third the tangent deflection angle θ, with a correction factor. The correction factor is negligible for values of less than 20°.

(3) For tangent deviations of less than 10°, value of the spirals is approximately equal to its length upto that point.

(4) For tangent deviation angles of less than 10° the K value of the spiral is approximately equal to half of X_C or half of the length of the curve.

(5) For tangent deviation angles less than 10° the intercept of the perpendicular from the centre of the circular curve to the tangent between the circular curve and the tangent is bisected by the transition. In other words the shift is bisected by the transition.

(6) The tangent distance T_S is approximately equal to half the length of the curve + $(R_C + s)$ tan $\frac{\Delta}{2}$.

(7) The offset distances from the tangent to the spiral are approximately equal to the distances between the spiral and its osculating circle at equal distance from the opposite ends of the spiral, Fig. 20.

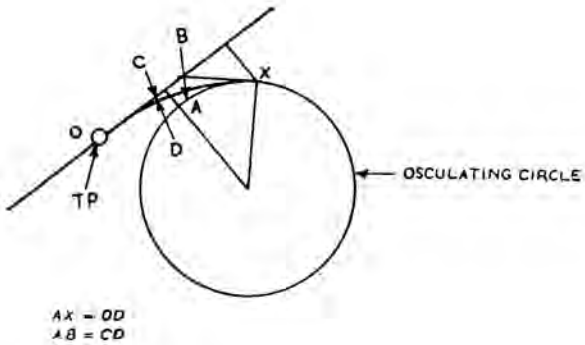


Fig. 20

7.6. **Design of Curves with Transitions**

7.6.1. In designing a road alignment, the angle of deviation in the alignment is known. The classification of the highway in which the curve is to be located is also known. If the terrain is one where there are no features which will restrict, the alignment it is desirable that the maximum possible radius be selected (see para 4.4.4). Table 9 gives the minimum transition lengths, Ls for different speeds and radii.

Having selected the radius (see para 4.4), suitable length for the transitions are chosen from Table 9. Then the various elements of the transition are worked out using the formulae given in para 7.5.2. and *Appendix 2.*

If two transitions of equal lengths are adopted on both sides of the central circular arc, the angle consumed by the circular curve is equal to $(\Delta - 2 \times \theta_s)$. The functions of spiral for various values of tangent deviation angle in steps of 0.1 degree up to 50° in steps of 0.5 for values between 50° and 70° and in steps of one degree from 70° to 135° are given in Table 12 (*Appendix 5*). The functions given are for unit length of the transition. Having known the θ_s and the length of the transition the values of the various functions are easily got by multiplying the appropriate values given in Table 11 with the length of the transition.

7.6.2. In practice, however, the alignment will be such that there are restrictions of terrain or a built up area which will not be free choice of the radius for the curve. Generally, the tangent distance *Ts* or the apex distance *Es* or both are the governing elements. There are various combinations of the radius of curve and the length of the transition which will give the values of *Es* and *Ts* that are required. Thus for any one set of field conditions to arrive at the best suitable value of *Ls* and *Rc* trial and error will be necessary. Therefore, Table 10 (Appendix 3) have been worked out to enable field engineers to select the maximum possible radius and length of transition best suited to the field conditions. Use of the tables to design curves is explained in para 7.7.

7.6.3. Example 11.2., illustrates that even under conditions where there are no restrictions in the field, calculation of curve functions are tedious. So curves functions for radii from 14 to 2500 m and transition length ranging from 15 to 140 m have been worked out and given in Tables 10 (Appendix 3), 11 (Appendix 4), & 12 (Appendix 5). In the field generally curves satisfying a range of the element that governs the design would be satisfactory. For example, if E_s governs the design a curve having E_s values a few *m* more or less than the desired value would fit into the alignment. So the large number of combinations of *Ls* and *Rc* that can be got from the tables are expected to cover the diverse conditions obtaining in the field. Thus it should, largely, be possible to select a curve of standard dimensions from among the curves for which values are figured in the tables to fit into even tight locations.

7.7. **Tables for Design and their Use**

7.7.1. Table 4 gives superelevation for different design speeds and radii and extra widths for different design radii.

Table 9 gives the minimum transition lengths for varioud design speeds and curve radii.

7.7.2. **Tangent and apex distances for plain and hilly country :** As mentioned already in para 7.6.2., generally the data that govern the design of curve are the deviation angle Δ, the tangent distance T_s and E_s the apex distance. Table 10 (Appendix 3) gives the tangent and apex distances for radii ranging from 14 to 2500 m and for transition lengths. 15 to 140 m for deviation angles from 6° to 120° These Tables are applicable to plain, rolling, mountainous and steep terrains.

In Table 10, (Appendix 3) zig-zag lines representing the various design speeds are figured thick black. Values to the right and top of the zig-zag lines are suitable for design speeds indicated at the end of the zig-zag lines. Curves with values figured below the zig-zag line for the concerned design speed are to be used only in exceptional conditions when it is impossible to fit in curves safe for the design speed or locations where fitting in curves satisfying the speed requirements is prohibitively costly.

7.7.3. It can be seen that the values figured are for standard radii ranging from 14-2500 m in Table 10 (Appendix 3). Ordinarily it should be possible to fit in one of these standard curves into the alignment even under restricted conditions. Only in rare cases, individual calculations for radii and transition lengths not figured in the tables should be required. For deviation angles less than 6° change in E_s values even for large variations in the radius of the curve is so small that a curve of of more than 1,000 m radius could easily be fitted in. Also transition curves are not required for curves greater than 1,000 m radius. Examples illustrating the use of the Tables are given separately in Chapter 11.

7.7.4. **Curves transitional throughout :** When a fully transitional curve is desired without a central circular curve, the total angle consumed by the transition which is the tangent deviation angle of the transition is equal to half the total deviation angle of the curve. For any one deviation angle, there are innumerable combinations of radii and the length of the transition which give a fully transitional curve. Table 13 gives the tangent and apex distances for fully transitional curves for deviation angles from 6° to 138°. The *Ts* and *Es* values figured are for a length of transition of

TABLE 13. TANGENT AND APEX DISTANCES OF CURVES TRANSITIONAL THROUGHOUT

$$T_S = (Rc + s) \text{ Tan } \frac{\Delta}{2} + k$$

$$Es = (Rc + s) \text{ ex sec } \frac{\Delta}{2} + s = \frac{Rc + s}{\text{Cos } \frac{\Delta}{2}} - Rc$$

$6° - 138°$

TANGENTS AND APEX-DISTANCE FOR Ls = 100 m

Δ°	Ts	Es	Δ°	Ts	Es	Δ°	Ts	Es
6°	100.064	1.747	53	105.452	16.966	100	125.475	42.852
7	100.087	2.040	54	105.680	17.352	101	126.216	43.687
8	100.114	2.332	55	105.913	17.742	102	126.980	44.544
9	100.144	2.625	56	106.153	18.137	103	127.765	45.422
10	100.178	2.918	57	106.399	18.536	104	128.573	46.321
11	100.216	3.212	58	106.651	18.940	105	129.405	47.243
12	100.257	3,507	59	106.909	19.348	106	130.261	48.189
13	100.302	3.802	60	107.124	19.762	107	131.142	49.158
14	100.350	4.098	61	107.446	20.181	108	132.049	50 152
15	100.402	4.396	62	107.724	20.604	109	132.983	51.172
16	100 458	4.693	63	108.010	21.034	110	133.947	52.220
17	100.518	4.992	64	108.302	21.468	111	134 941	53.298
18	100.581	5.292	65	108.602	21.908	112	135.965	54.406
19	100·648	5.593	66	108.909	22.355	113	137.022	55.544
20	100.719	5.895	67	109.223	22.807	114	138.113	56.715
21	100 794	6.198	68	109.546	23.266	115	139.239	57.921
22	100.873	6.502	69	109.876	23.731	116	140.405	59.163
23	100.955	6.808	70	110.214	24.203	117	141.602	60.443
24	101.042	7.115	71	110.561	24.681	118	142.846	61.763
25	101.132	7.424	72	110.917	25.167	119	144.123	63.126
26	101.226	7.734	73	111.281	25.660	120	145.463	64.532
27	101.324	8.045	74	111.654	26.161	121	146.840	65.983
28	101.427	8.358	75	112.036	26.669	122	148.267	67.484
29	101.533	8.674	76	112.427	27.186	123	149.747	69.036
30	101.644	8.990	77	112.828	27.710	124	151.281	70.641
31	101.758	9.309	78	113.240	28.244	125	152.871	72.302
32	101.877	9.630	79	113.661	28.786	126	154.523	74.023
33	102.000	9.952	80	114.092	29.337	127	156 239	75.808
34	102.128	10.277	81	114.535	29.898	128	158.024	77.661
35	102.260	10.604	82	114.988	30.464	129	159.882	79.585
36	102.396	10.933	83	115.453	31.048	130	161.816	83.661
37	102 537	11.265	84	115.930	31.639	131	163.828	81.503
38	102.682	11.599	85	116.418	32.241	132	165.926	85.825
39	102.832	11.936	86	116.919	32.854	133	168.116	88.079
40	102.987	12.275	87	117.433	33.478	134	170.405	90.428
41	103.146	12.617	88	117.960	34.115	135	172.797	92.880
42	103.310	12.962	89	118.500	34.763	136	175.300	95.445
43	103.479	13.309	90	119.054	35.425	137	177.668	98.120
44	103.653	13.660	91	119.623	36.099	138	180.668	100.434
45	103.831	14.012	92	120.207	36.788			
46	104.015	14.370	93	120.806	37.490			
47	104.204	14.730	94	121.421	38.207			
48	104.399	15.094	95	122.052	38.940			
49	104.598	15.460	96	122.700	39.688			
50	104.804	15.831	97	123.366	40.453			
51	105.014	16.206	98	124.050	41.234			
52	105.230	16.584	99	124.753	42.430			

Rc = Curve Radius
Ts = Tangent Distance
Es = Apex Distance
Δ = Total Deviation Angle
s = Shift
k = The Distance along the straight from T.P. to P.C.

100 m. For lengtns other than 100 m, the values will have to be proportionately increased or decreased. The examples in the Chapter 11 show the use of Table 13 for design of fully transitional curves.

7.8. Set Out of the Transition Spiral

7.8.1. From the design of the curve, *Ts* the tangent distance, *Es* the apex distance, *Ls* length of the transition, *Rc* the radius of the circular curve, and Δs the tangent deviation of the transition, etc., are known. The start of the curve *TP* is fixed by measuring the *Ts* from the apex point of the curve which is fixed in the alignment. Where the *PI* the apex point is not accessible, *TP* the start of the curve may be established with reference to known objects shown in the plans the distances being sealed. The curve is laid out in the field by any one of the following methods :

(1) Off-sets from the tangent method

(2) Off-sets ‡ point method

(3) Off-sets from the tangent and the circular method

(4) Polar deflection method

Usually the length of the tangent is divided into 10 or 20 equal parts and it is assumed that the length of the chord of each to the point is the same as the length along the curve. This assumption is correct for transition lengths of less than 120 m even for sharp curves.

7.8.2. **Off-sets from the tangent :** This method is suitable where instruments for measuring angles accurately are not available and the topography of the country permits the laying of off-sets. It has the advantage that it can be laid out by the field staff who generally are not conversant with the use of the theodolite. When the off-sets exceed 15 m care has to be taken to align the off-set perpendicular to the tangent as otherwise accuracy of the lay out will be affected and after laying the curve the C.T. point is checked by measuring the distance L.C. from the tangent and aligning the triangle L.T.—S.T.—L.C.

7.8.3. **Off-sets to ‡ point method :** This method is the same as the tangent off-set method except that the number of points to which off-sets are measured is small. The method can be adopted where accuracy is not essential as in the lay-out of embankments, etc.

7.8.4. **Off-sets from the tangent and the circular curve :** As mentioned in para 7.5.5. the spiral deviates from the circular curve at the same rate as it leaves the tangent. Therefore, offsets from the circular curve are the same as that from the tangent except that the distances are measured along the circular curve from the C.T. The method has the advantage that it can be used if there are any obstructions for measuring the offsets from the tangent. The C.T. point is first located by L.T., S.T. and L.C. and the circular curve laid out, from the short tangent. Alternately the P.C. point is first located by using *K* and the shift. A line parallel to the main tangent is aligned from the P.C. and the circular curve laid from this tangent. This method has the advantage that the circular curve beyond *C.T.* can also be laid. Another advantage of the method is that the offsets are small compared to the tangent off-set method. Since the laying of circular curve is a involved layout, using this method suffers from the disadvantage that it cannot be entrusted to lower field staff.

7.8.5. **Polar deflection method :** The method is suitable for all conditions and gives accurate results. If laying out of the full length of the transition is not feasible from the start of the curve, the method permits shifting of the instrument to a suitable intermediate station and ranging the curve forwards or backwards from that station.

7.8.6. The method using offsets from the tangent though simple to lay out on the field, involves elaborate calculations. Therefore, to avoid waste of effort and to facilitate field set out without any

calculations whatsoever, the offset distances, namely, the X and Y distances to the various points in the spiral for the 26 standard lengths of transition, viz. 15 to 30 m and 14 radii ranging from 14 to 2500 m have been presented in Table 11 (Appendix 4) giving set out Tables for Transition Curves. The offsets have been worked out for the 10–chord spiral for lengths of transition of 30 m and above and for 5 equal chord for lengths of transitions of 15 m and 20 m, since it is considered that offsets of chords of 3 m-5 m in length give accurate curve. Therefore if the chosen length of the transition and the radius of curve is a standard one—it should always be the aim to choose a standard one-all that one has to do is to merely refer to the appropriate length and radius and lay the curve in the field. Besidse offsets from the tangent, Table 11 (Appendix 4) presents the polar deflection angles for the 10—chord points for transitions of 30 m and above, 5—chord points for transitions of 15 m and 20 m. In addition, the values of the long tangents, the short tangent, the long chord, the s and the K-value have also been figured for the standard transitions. Values of L.T., S.T., L.C., etc. are useful for checking the end point of the transition CT after it has been laid out. If due to limitations of topography it is not possible to locate the end of the transition from the start of the curve, the L.T., θs, and S.T., could be used for locating the end of the transition C.T. The instruments could then be shifted to that point and the curve ranged backwards.

7.8.7. For conditions where the length of the transition or the radius of the curve is not one for which ready-made set out tables are available to enable calculations of the polar deflection angles from the start or end or any intermediate point of the transition, coefficients of polar deflection angle for 10—chord set out with instruments set up at the various points is given in Table 14 which also gives the correction factors in minutes for a tangent deflection angle of 20° and above. No correction factors for the polar deflection angle when θ is 20° and below is necessary. Examples 11.17. to 11.24. show the method of calculations for field set out.

7.9. Use of Tables for Set Out

7.9.1. Set out of transition by tangent off-set/method when the curve chosen is a standard one

(a) **Offsets measured from the main tanget :** When the curve to be set out has its radius and length of transition equal to one of the values figured in Table 11 (Appendix 4), no calculations whatsoever are necessary for its set out in the field. Lengths equal to $X_1, X_2, X_3, \ldots\ldots X_{10}$ are measured along the tangent and offsets equal to Y_1, Y_2, Y_3, etc., Y_{10} respectively, are measured perpendicular to the tangent. The line joining the points so laid out is the required transition. As a measure of check the distance between the point X_{10}, Y_{10} and $T.P.$, the start of the curve, should be equal to the appropriate value $L.C$ figured in the table. The short tangent or the $S.T.$ is obtained by joining X_{10}, Y_{10} or the $C.T.$ to the point on the main tangent at a distance equal to the appropriate value of the $L.T.$ figured in Table 11 (Appendix 4). If the short tangent is produced, it will serve as a base line for laying the circular portion of the curve. A worked out example is given in Chapter 11 as example No. 11.17.

(b) **Set out when offsets cannot be measured from the main tangent :** When it is not possible to measure the offsets from the main tangent say, beyond the first five points of the 10—chord spiral, the point $P.C.$ is first fixed in the field. For this, the K-value of the appropriate curve and s are read out from Table 11 (Appendix 4). The point at a distance of K along the tangent and s perpendicular to the tangent is PC. The line parallel to the main tangent is laid out at PC. Set out of the forward portion of the curve, i.e., from PC can be done with this line as base. In this case the values given in the Table for X_6, X_7,.....X_{10} should be reduced by the value K, figured for the appropriate curve. The values Y_6, Y_7,..... Y_{10} etc. should be reduced to an amount equal to the s figured in the table. If minus values are obtained the offsets should be measured on the main tangent side of the line. When positive values are got, the offsets should be measured on the side away from the main tangent. Alternately the circular curve is laid out from the point PC upto the point CT and the

TABLE 14. COEFFICIENTS FOR POLAR DEFLECTIONS FOR 10 CHORD SPIRAL WITH INSTRUMENT SET UP AT VARIOUS POINTS-FOR FORWARD ANGLES $\alpha° = \theta°_s \times k$ (COEFFICIENT) = C + FOR BACKWARD ANGLES α AND θ ARE IN DEGREES WHILE C IS IN MINUTES

Values of Coefficient *Table 14-1*

Coeft. for correction angle	To Point NP	INSTRUMENT SET UP ON POINT NUMBER											To Point	Coeft. for correction angles
		O.T.P.	1	2	3	4	5	6	7	8	9	10C.T.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
0 00	0		0.0267	0.8267	0.8600	0.1067	0.1667	0.2400	0.3267	0.4267	0.5400	0.6667	0	1.00
0 01	1	0.0033		0.0167	0.0457	0.0900	0.1467	0.2167	0.3000	0.3967	0.5067	0.6300	1	0.81
0 04	2	0.0133	0.0133		0.0267	0.0667	0.1200	0.1867	0.2667	0.3600	0.4667	0.5867	2	0.64
0 09	3	0.0300	0.0333	0.0233		0.0367	0.0867	0.1500	0.2267	0.3167	0.4200	0.5367	3	0.49
0 16	4	0.0533	0.0600	0.0533	0.0333		0.0467	0.1067	0.1800	0.2651	0 3667	0.4800	4	0.36
0 25	5	0.0833	0.0933	0.0900	0.0733	0.0453		0.0367	0.1267	0.2100	0.3067	0.4167	5	0.25
0 36	6	0.1200	0.1333	0.1333	0.1200	0.0933	0.0533		0.0667	0.1467	0.1400	0.3469	6	0.16
0 49	7	0.1633	0.1800	0.1833	0.1733	0.1500	0.1133	0.0533		0.0767	0.1687	0.2100	7	0.09
0 64	8	0.2133	0.2333	0.2400	0.2333	0.2133	0.1800	0.1333	0.0733		0.0867	0.1867	8	0.04
0 81	9	0.2700	0.2933	0.3033	0.3000	0.2833	0.2533	0.2100	0.1533	0.0833		0.0867	9	0.01
1 00	10	0.3333	0.3600	0.3733	0.3733	0.3600	0.3333	0.2933	0.2400	0.1737	0.0933		10	0.00

To Left of Diagonal Line Read Down for Forward Angles – (Subtract Correction Factor)
To Right of Diagonal Line Read up for Backward Angles + (Add Correction Factor)

TABLE 14-2. VALUE OF C IN MINUTES IN FORMULA OF $\alpha = K\theta_s \pm C$ FOR DIFFERENT VALUES OF $\theta_s \times$ COEFFICIENT IN COLS. 1 AND 15.

θ IN DEGREES	20	25	30	35	40	45	50	55
C IN MINUTES	0.4	0.8	1.4	2.2	3.4	4.8	6.6	8.8

Correction indicated in Note 3 is not necessary in ordinary cases unless very great accuracy is aimed at and possible to achieve and maintain in the field for θ_s of 20° & less no correction is necessary.

Notes :

1. The Tables are to be used for setting out transition by angular instrument by polar deflection from any one chord point to any other in a 10 chord spiral chord length is assumed as $\frac{L_s}{10}$

2. Table 14.1. gives the coefficients which when multiplied by θ_s will give the polar deflection from the tangent at station point to the forward or backward station Example $\theta_s = 30°$
 (i) Polar deflection from T.R. (STN./O) to STN. 8 (Forward) = 0.2133 × 30° = 6.399°
 (ii) Polar deflection from STN. 3 to STN. 9 (Forward) = 0.300 × 30° = 9°
 (iii) Polar deflection from STN. 3 to STN. 8 (Backward) = 0.0600 × 30° = 1.8°
 For correction see below

3. Polar deflection $\alpha = K\theta_s \pm C$ Table 14-I gives the first factor Table 14-2 gives the second factor as explained below:
 (i) θ_s is multiplied by the appropriate constant in col. 1 or col. 15 and if the product exceed 20° the correction in minutes is obtained from table 14-2. This is to be subtracted from first factor, for forward STN angles and added for backward STN. angles.
 (ii) For $\theta_s = 30°$ from STN. point 0 to STN 8 polar deflection = 6.399. For correction multiply by constant in Col. 1 against STN 8. The correction angle = 0.64 × 30' = 19.2' which is less than 20°. No correction necessary.
 (iii) For $\theta_s = 30°$ from STN 3 to STN 9 polar defln. = 9° correction $\theta_s \times 0.81 = 30 \times 0.81 = 24.3'$. This exceeds 20° correction from Table 14-2 (interpolated is 0.7 min). The correction value of $\alpha = 9° - 0.7' = 8° - 59.3'$
 (iv) Polar defln. from STN. 3 to STN 0 (Backward) = 1.8° Correction angle 30° × 1.00 = 30° From Table 14-2 Correction in minures = 1.4. Corrected defln. angle = 1.8 + 1.4' = 1° – 49.4

transition is set out making use of property described in para 7.5.6 (7). The example 11.18. illustrates this.

7.9.2. **Set out for a transition with odd values for length or radius :** When the transition designed has either its length L_S or radius R_C or both not equal to the values figured in Table 11 (Appendix 4) individual calculations are required. Ordinarily conditions obtaining in the field will not be so rigorous as will admit of only one curve. Usually there is a range, small though it might be, within which the curve could be shifted. Therefore, it should be possible to choose a curve having standard values worked out in Table 11 (Appendix 4). Only in very rare cases will a curve other than that for which values are not figured in Table 11 (Appendix 4) will have to be set out. Example 11.19. illustrates the method of calculation.

7.9.3. **Off-sets to $\frac{1}{4}$ points :** This method is based on the formulae that at any point X, the offset Y is equal to $\left(\frac{L}{L_s}\right)^3 X\ Y_c = \left(\frac{X}{X_c}\right)^3 X\ Y_c$ approximately.

Therefore, the X_c and Y_c are first calculated for curves with odd values of length or radius of the spiral. For spirals with standard values of radius or length figured in the Table 11 (Appendix 4), there is no need to use this method as the offsets could be read directly from the tables given. The offsets at the $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ points are equal to $\frac{1}{64}\ Y_c$, $\frac{1}{8}\ Y_c$ and $\frac{27}{64}\ Y_c$ respectively. Example 11.20. illustrates this. This method is useful in laying out earthwork for formation.

7.9.4. **Polar deflection method :** For any one chosen curve, the first step in the field lay-out by the Polar deflection method is to calculate the value of θ_s. For this the formula

$$\theta_s = L_s \times \frac{28.65}{R_c} \text{ (degrees)}$$

is used. Then the deflection angles to the chord points of the 10-chord spiral are calculated by using Table 15 coefficients of Polar Deflection for 10-chord spiral. This table gives the coefficients which when multiplied by the θ_s will give the polar deflection angle for the various points on the curve for instrument set up at the different points. When the instrument is set up at T.P. i.e., at the start of the curve, the polar deflection angles at various points 1, 2, 3 etc., are obtained by multiplying θ_s with the values figured in column 3, i.e., the instruments set up at 0. If the instrument set up is required at point say 4, the polar deflection angles from station 4 to points 5, 6, 7, 8 etc., are obtained by multiplying θ_s with the value 0.0433, 0.0933, etc., in column 7 for forward set out. It set out in the back direction is required, the polar deflection angle from 4 to stations 3, 2, 1 and 0 are obtained by multiplying the θ_s value with 0.0367, 0.0667, etc., given in column 7. When θ at the point at which instrument is sighted exceeds 20° a correction factor is required to the value obtained from the table. The method of applying corrections is explained in Table 14.

7.9.5. To avoid computation, values of polar deflection angle for 10-chord spirals of 22 standard lengths from 15 to 140 m and 44 standard radii from 14 to 2500 m have been worked out and figured in Table 11 (Appendix 4). The polar deflection angles given in the table are for the instrument set up at the start of the curve. If set up of instrument at intermediate point is necessary, individual values will have to be worked.

7.9.6. **Procedure for laying a spiral by polar deflection :** Set the instruments at TP, range the instrument to T.P-P.I. with both plate clamped and the reading set to 0. Unclamp the top plate, turn the reading to α_1 for point 1, α_2 for point 2, etc.

Range a length equal to 1/10 of the chosen transition from T.P. and find a point in the sight

line with α_1 as the reading whose length is equal to $\frac{L}{10}$. The resulting point 1 lies on the transition. Find a point whose distance is $\frac{L_s}{10}$ from the point so obtained and in the sight line with α_2 as the readindg. This point is a point on the transition. The other points are laid similarly.

After laying out the transition in the field as a measure of check, the instruments may be shifted to a point on the main tangent at a distance equal to the L.T. of the curve from P.T. With zero reading the theodolite should be sited to point PI or any other point of the main tangent, the top plate unclamped and the reading set to θ_s. This sight line should pass through the C.T. The distance from the instrument set up point to C.T. should be equal to the short tangent. Examples of calculation are given in Ex. 11.21.

7.10. Design of Curves in Tight Locations

7.10.1. Whenever a curve has to be designed as mentioned already, the controlling factors in the field are Δ the deviation angle, T_s the tangent distance, and E_s the apex distance. The design requirements are the minimum radius of the curve and the minimum length of the transition for various design speeds. Δ is fixed by the alignment and T_s and E_s distances suitable to the curve depend upon the topographical conditions at the curve. Generally, there is a range in the values of T_s and E_s within which the curve could be located with round values for which values are figured in Tables 10 (Appendix 3) and 11 (Appendix 4). But there may be field conditions in which the curve cannot be located with round values for the radius and length of the transition. For example, the E_s or T_s distances have to be equal to a specific value or when the curve has to pass through a predetermined point or when the shift of the curve has to be exactly equal to a specific value. Under such conditions, the curve will have to be designed to suit the field limitations. Such a case will generally arise when introducing transitions on existing roads with circular curves. Examples illustrating the use of Tables for design for special locations have been worked out in Example 11.3. Examples of curves with unequal transitions are given in Example 11.25.

7.10.2. **Adjusting existing alignments for transitions:** Important roads in the country have been aligned when the internal combustion engine was not on the roads. Therefore, many of the curves on the through routes do not have either transitions or superelevation. In restricted locations, specially at approaches to bridges where a cork-screw alignment was chosen, in order to enable a square crossing of the river and near built-up areas through which the road passes, very sharp curves are in existence. Unless these are improved by provision of curves of adequate radius, suitable transitions and superelevation, travel at the design speed of the road will be hazardous. Insertion of transition where they do not exist will soothen the abrupt change of direction specially when entering a sharp curve. It will enable the driver to decelerate in order that he can negotiate the sharp curve that lies ahead. It will also provide the necessary distance in which superelevation can be built in. So introduction of transitions even in curves not up the standards will be an advantage. It is essential that good visibility should be provided to the driver and the outside of curve planted with white-washed guard-stones so that he can have an idea of the amount of turning he has to make. The above mentioned improvement is only a paliative. Real improvement lies in increasing the radius of curvature. But, such improvements will necessitate acquisitions of new land. Nevertheless, ordinarily it is possible to improve existing curve without acquiring land when the land width of the road available at the site is fairly wide. Table 15 which gives the values of shifts for various transition lengths and curve radii, shows that the amount of shift required for a transition curve of 55 m length with a radius of 80 m is 1.567 m. This means that the central line of the existing road would be shifted inward by 7.367 m. So insertions of spirals for existing circular curves will be possible in most locations without acquiring fresh land.

TABLE 15. VALUE OF SHIFTS FOR VARIOUS TRANSITION LENGHTS AND RADII
(All curve functions in metres)

Radius	Design Speed in Kilometres Per Hour (V)																			
	100				80				65				50				40			
	P		H		P		H		P		H		P		H		P		H	
R_C	L_S	s	L_S	s	L_S	s	L_S	s	L_S	s	L_S	s	L_S	s	L_S	s	L_S	s	L_T	s
15																				
20																				
25																				
30																				
40																			—	
45																			NA	
50																			40	1.274
55																			40	1.161
60													—	—	—		75	3.819	35	0.848
70													—	—	NA		65	2.498	30	0.536
80													NA	—	55	1.567	55	1.567	25	0.325
90													75	2.591	45	0.937	50	1.156	25	0.289
100									—				70	2.034	45	0.841	45	0.841	20	0.167
125									NA				55	1.007	35	0.407	35	0.407	15	0.075
150									80	1.774			45	0.562	30	0.250	30	0.250	15	0.062
170									70	1.197			40	0.391	25	0.153	25	0.153	15	0.055
200	—				NA				60	0.750			35	0.256	20	0.082	25	0.129	15	0.047
250	—				90	1.351			50	0.417			30	0.149	15	0.038	20	0.066	15	0.038
300	NA				75	0.782			40	0.222			25	0.087	15	0.031	NR	—	NR	
350	130	2.013			60	0.427			35	0.146			20	0.047	15	0.027	—		—	
400	115	1.381			55	0.316			30	0.094			20	0.042	15	0.024				
500	95	0.755			45	0.165			25	0.052			NR	—	NR					
600	80	0.443			35	0.085			20	0.028										
700	70	0.292			35	0.072			20	0.024										
800	60	0.189			30	0.047			NR											
900	55	0.140			30	0.042														
1000	50	0.103			30	0.038														
1200	40	0.056			NR	—														
1500	35	0.034																		
1800	30	0.020																		
2000	NR	—																		

SPEED NOT APPLICABLE

SPEED NOT APPLICABLE

SPEED NOT APPLICABLE

NOTATION

P = Plain and Rolling Terrain
H = Mountainous and Steep Terrain
NA = Radius not applicable
NR = Transition not required
L_S = Transition Length (m)
R_C = Design Radius (m)
s = Shift of spiral from circular curve of Radius R_e (m)

TABLE 15

Radius	Design Speed															Radius	
	35				30				25				20				
	P		H		P		H		P		H		P		H		
R_C	L_S	s	L_S	s	L_S	s	L_S	s	L_S	s	L_S	s	L_S	s	L_S	s	R_C
15					—		—		—		NA		NA		30	2.413	15
20					—		—		NA		35	2.484	55	5.893	20	0.826	20
25					NA		NA		70	7.619	25	1.0325	45	3.280	20	0.663	25
30					80	8.342	30	1.239	60	4.825	25	0.864	40	2.188	15	0.312	30
40	NA		35	1.260	60	3.676	25	0.648	45	2.086	20	0.416	30	0.933	15	0.235	40
45	75	5.081	30	0.831	55	2.763	20	0.369	40	1.471	15	0.208	25	0.578	15	0.208	45
50	70	4.012	25	0.521	50	2.065	20	0.333	35	1.017	15	0.187	25	0.521	15	0.187	50
55	60	2.697	25	0.473	45	1.525	20	0.303	30	0.680	15	0.170	20	0.303	15	0.170	55
60	55	2.086	25	0.433	40	1.108	15	0.156	30	0.625	15	0.156	20	0.278	15	0.156	60
70	50	1.481	20	0.238	35	0.729	15	0.134	30	0.536	15	0.134	15	0.134	15	0.134	70
80	45	1.054	20	0.208	30	0.469	15	0.118	25	0.325	15	0.118	15	0.118	15	0.118	80
90	40	0.739	15	0.104	30	0.417	15	0.104	20	0.185	15	0.104	15	0.104	15	0.104	90
100	35	0.509	15	0.094	25	0.289	15	0.094	20	0.167	15	0.944	NR		NR		100
125	30	0.299	15	0.075	20	0.133	15	0.075	15	0.075	NR						125
150	25	0.174	15	0.062	15	0.062	15	0.062	15	0.062							150
170	20	0.097	15	0.055	15	0.055	NR		NR								170
200	20	0.083	15	0.047	15	0.047											200
250	NR		NR		NR												250
300	—																300
350	—																350
400																	400
500																	500
600																	600
700																	700
800																	800
900																	900
1000																	1000
1200																	1200
1500																	1500
1800																	1800
2000																	2000

7.10.3. The following are some of the methods by which transitions could be introduced into existing circular curve alignments.

(1) The radius of the curve is reduced by an amount equal to the shift of the proposed transition and the transition introduced. This will necessitate no change in the alignment of the straight portions, Fig. 21.

(2) The radius of the original curve is retained and its centre shifted by an amount equal to $\frac{s}{Cos\ \frac{\Delta}{2}}$ thus providing the necessary space for the introduction of the transition. Here also the straight portions are not to be shifted, Fig. 22.

(3) The original circular curve is retained and the straights shifted by an amount equal to the shift which is required for accommodating the transition. It is necessary that the effect of the shifting of the tangents on the adjoining curves be considered before adopting this method, Fig. 23.

(4) Curves of radii shorter than the radius of the existing curve are introduced at the ends retaining as much as possible of the curve and transitions are provided at the ends of the newly introduced sharper curve. The sharper curve provides the necessary space for introducing the transition, Fig. 24. Even though this method retains as much of the exististing curve as possible the radius of the curve is reduced. So it should be employed only when the radius of the existing curve is substantially larger than the minimum applicable to the case. It should also be ensured that the circular curve introduced should not be much less than the existing one.

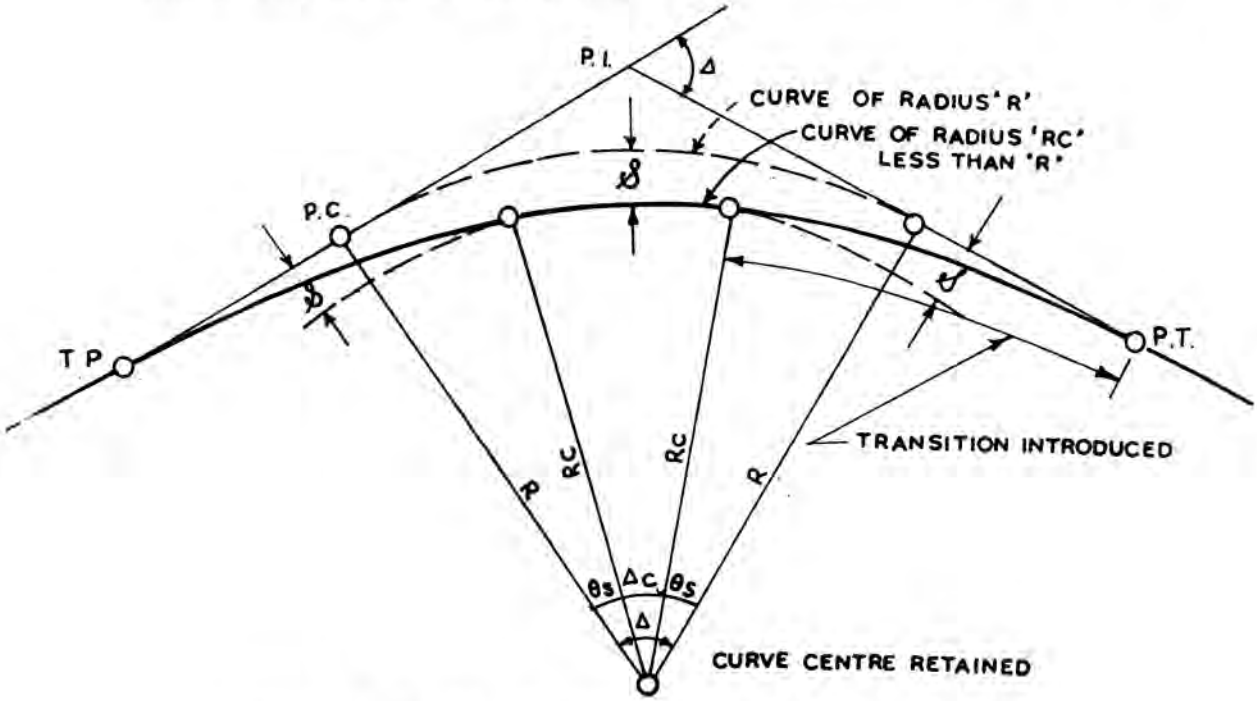


Fig. 21. Radius of the original curve is reduced by an amount equal to the shift of the transition

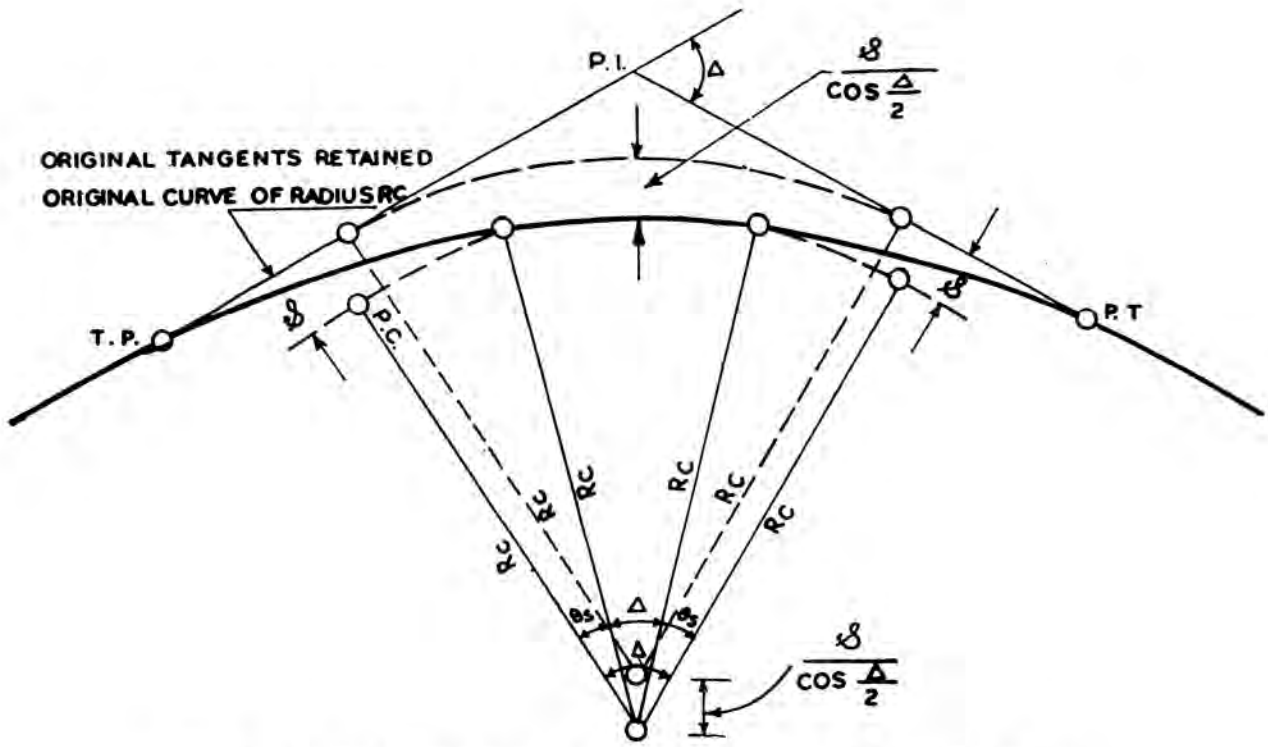


Fig. 22. Radius of the original curve is not altered the centre of the curve being shifted

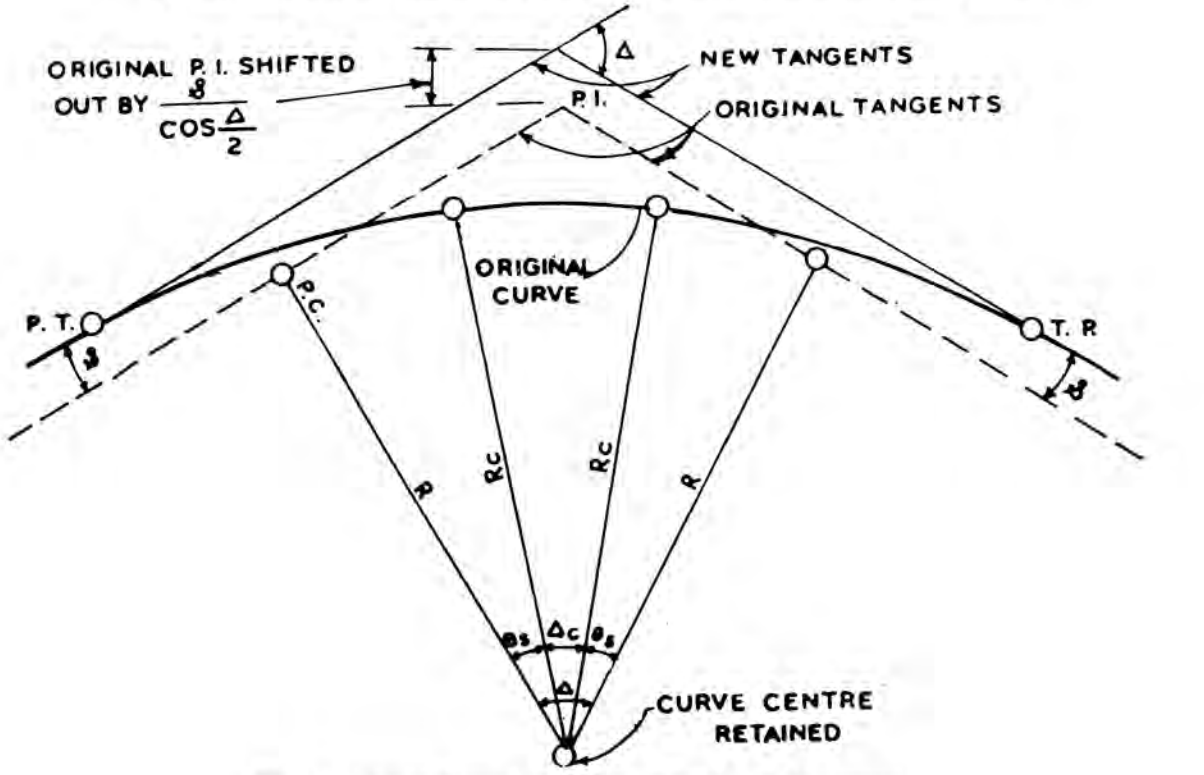


Fig. 23. Original circular curve retained by shifting the tangents

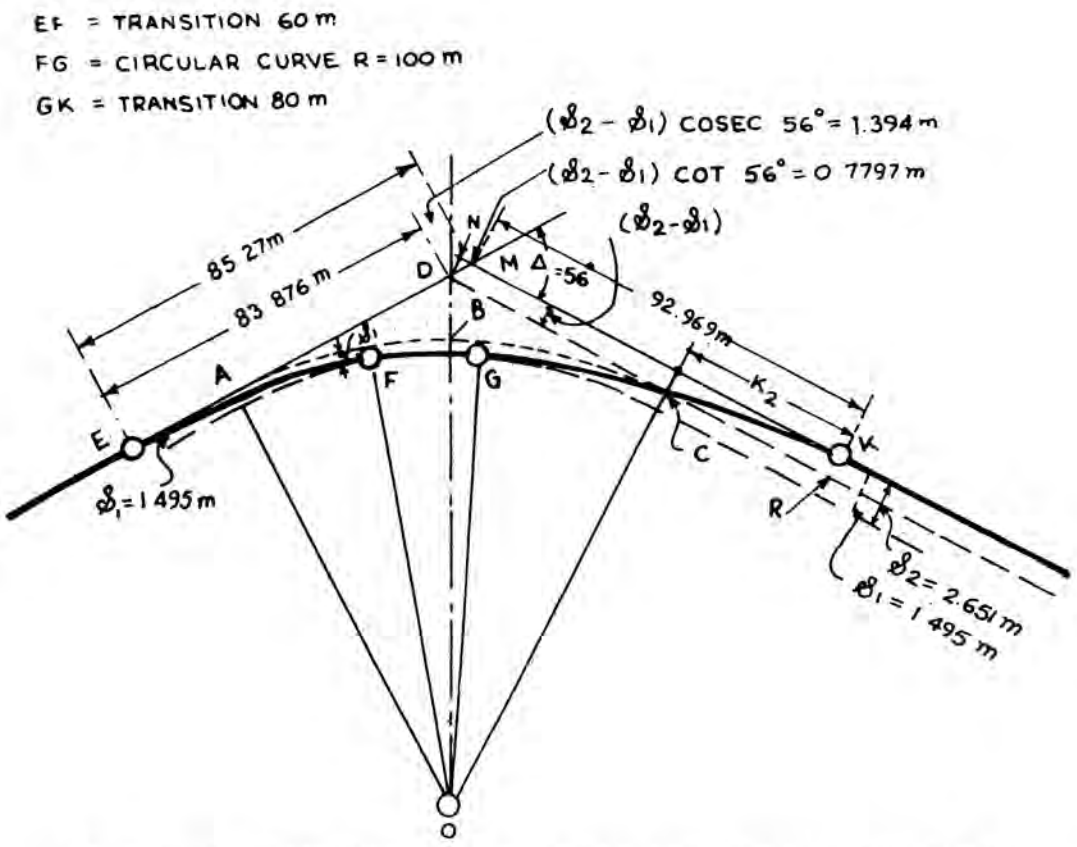


Fig. 24. Circular curve sharper than the existing curve with transitions is introduced at the ends

An analysis of Table 11 (Appendix 4) shows that for accommodating a transition curve of 100 m length for a radius of 250 m, a shift of 1.664 m is required. Similarly for a radius of 100 m, the shift necessary for a transition of 30 m is 0.375 m. So transitions could easily be introduced in most of the existing curves within the width of the road land by increasing the width of the embankment.

Examples 11.26. to 11.28. illustrate the calculations necessary for introducing transitions in existing alignment.

8. TRANSITIONS FOR COMPOUND CURVES

8.1. When the Tangents have not yet been Fixed or when they can be Moved

Transitions are used between curves of different radii to change gradually from one circular motion to another of greater or less degree and to permit a corresponding change in superelevation. The sharper curve must necessarily lie inside the flatter curve.

The length of transition required is the difference between the lengths required for changing from a longitudinal to a circular motion for each curve so that

$$L_s = \frac{0.0215\ V^3}{CR_2} - \frac{0.0215\ V^3}{CR_1}$$

$$= \frac{0.0215\ V^3}{C}\left(\frac{1}{R_2} - \frac{1}{R_1}\right)$$

The last term of the equation is the reciprocal of the radius for a curve of a degree equal to the difference of the two curves so that

$$L_s = \frac{0.0215\ V^3}{CRa}$$

which is essentially the formula for the length of any transition except that Ra represents the radius of a curve of a degree equal to the difference between the degrees of the two curves.

To change gradually from the superelevation of one curve to that of another the slope of the outer edge of pavement with respect to the centre line should not be steeper than 1 in 150 so that the minimum length of transition should be at least 150 times the difference between the full supere levation of the two curves.

Compounding two curves that differ in radius by more than 50 per cent of the smaller radius results in a sudden change of curvature which is noticeable if the transition is omitted. A transition at least 30 m long should be inserted. Where two curves differ in radius by less than 50 per cent and the preceding methods of design result in transitions less than 30 m long they may be omitted and such change in superelevation as may be required can be effected on the flatter curve.

8.2. Example

Determine the length of transition required between two curves of radii 600 m and 250 m for design speed of 80 km/h.

$$C = 250 \text{ m} = \frac{80}{75 + 80} = 0.5161$$

$$\frac{1}{Ra} = \frac{1}{250} - \frac{1}{600} = 0.00233$$

$$L_s = \frac{0.0215 \times 80 \times 80 \times 80 \times 0.00233}{0.5161} = 49.69 \text{ m say } 50 \text{ m}$$

For a pavement 7 m wide the difference in elevation between the centre line and the edge of the fully superelevated section in Table 4.

$(0.07 - 0.047)\ 3.5 = 0.0805$ m

$150 \times 0.08 = 12$ m (less than 50 m)

$\therefore\ L_s = 50$ m

8.3. Symbols for Transitions for Compound Curves

All subscripts I refer to the flatter curve and subscripts 2 to the sharper curve, Fig. 25

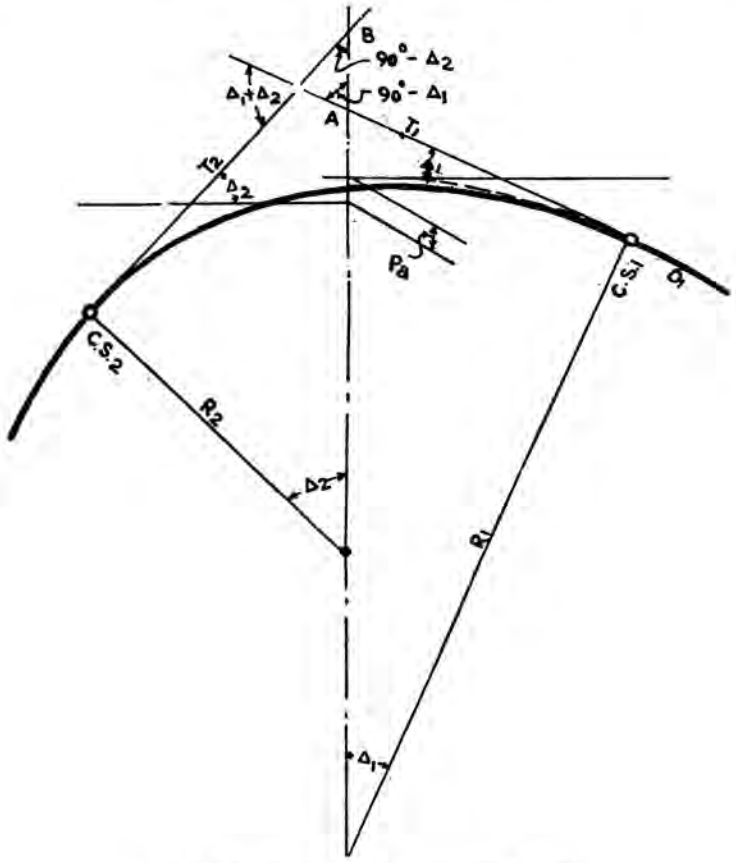


Fig. 25. Transition for compound curve

$C.S._1$ and $C.S._2$	Common points of curves and spiral curve
R_1 and R_2	Radii of the circular curves
L_a	Length of transition $C.S._1$ to $C.S._2$
I	Point of intersection of tangents at $C.S._1$ and $C.S._2$
T_1 and T_2	Tangent distances $C.S._1$ and $C.S._2$ to I
P_a	Offset distance between the circular curves produced at the common radius
Δ_1 and Δ_2	Intersection angles between the tangents at $C.S._1$ and $C.S._2$ and the parallel tangents of the circular curves produced at the common radius
D_1 and D_2	Degree of curvature of the circular curves
R_a	Radius of curve of degree $D_2 - D_1$
O_a	"Equivalent" spiral angle

8.4. Details of the Transition for Compound Curves

The transition connecting two curves of different radii has the same characteristics as a transition connecting tangent and curve except that the degree of curve is the difference of the degrees of curvature of the circular curves.

Thus, if R_1 is the radius of the flatter curve and R_2 that of the sharper curve

$$\theta_a = 28.65 \times L_a \times \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

That is termed the "Equivalent" spiral angle since it is not the central angle of the actual spiral. The common radius disects the spiral so that the actual central angle may be computed by adding the central angle for each curve for half the length of spiral.

$$\Delta_1 = 28.65 \frac{L_a}{R_1}$$

$$\Delta_2 = 28.65 \frac{L_a}{R_2}$$

$$\Delta_1 + \Delta_2 = 28.65\ L_a \left(\frac{1}{R_1} + \frac{1}{R_2} \right)$$

The equivalent spiral angle may be used in Table 12 (Appendix 5) to find P_a the offset between the two circular curves at the common radius.

Where compound curves are required the center line is often located without first establishing the normal tangents. To avoid the laborious work of adjusting the circular curves to permit insertion of transitions, allowance should be made for a transition at each change of curvature before proceeding with the circular curve ahead. At the *P.C.* and *P.T.* this may be done by means of the spiral tangents or long chord as heretofore described. Spiral tangents also may be computed for a transition at a *P.C.C.* of a compound curve as follows :

$$\Delta_1 = \frac{28.65\ L_a}{R_1}, \quad \Delta_2 = \frac{28.65\ L_a}{R_2}$$

$$AB = R_2 \text{ exsec } \Delta_2 - R_1 \text{ exsec } \Delta_1 - P_a$$

$$AI = AB \times \frac{Cos\ \Delta 2}{Sin\ (\Delta_1 + \Delta_2)}, \quad BI = \frac{AB \times Cos\ \Delta_1}{Sin\ (\Delta_1 + \Delta_2)}$$

$$T_1 = R_1 \times Tan\ \Delta_1 + AI,\ T_2 = R_2 \times Tan\ \Delta_2 - BI$$

Example 11.33. illustrates the application of these formulae.

8.6. Locating the Transition for Compound Curves

Method 1. — Offsets from the circular curves. — In this method the spiral is located by offsets from both circular curves which are located first. The offset at the mid-point of the spiral is $\frac{p_a}{2}$ and the offset at any other point is equal to $\frac{p_a}{2}$ multiplied by the cube of the proportion of the distance from the nearer *C.S.* Offsests from the sharper curve are, of course, outward and from the flatter curve inward. Example 11.34. illustrates this method.

Method 2. — Deflection angles to even stations. — When using this method the deflection angles may be computed in the same manner as for a set-up on an intermediate point of a spiral connecting tangent and circle. The deflections for a circular curve of the radius of curve at the point

of set-up are first calculated. If set-up on *C.S.1.*, R_1 is the radius of curve, if set-up on *C.S.2*, R_2 is the radius of curve and if set up on an intermediate point distance L from the $C.S._1$,

$R = R_1 + \frac{L}{L_a} \times (R_2 - R_1)$. If L is measured from the $C.S._2$ of the sharper curve,

$R = R_2 - \frac{L}{L_a} \times (R_2 - R_1)$. These formulae follow from the fact that the radius of curvature varies directly as the length of spiral beginning with R_1 at $C.S._1$ and increasing uniformly to R_2 at $C.S._2$.

Spiral deflections computed in the same manner as for any other spiral using the equivalent spiral angle are then added to or subtracted from the circular curve deflections. They must be added if sighting toward the sharper curve and subtracted if sighting toward the flatter curve. Example 11.35. illustrates this method.

Method 3. — Deflection angles to a 10-chord spiral. — This method is similar to method 2 except that the spiral is divided into 10 equal parts and the spiral deflections which are added to or subtracted from the circular curve deflections are more easily computed by the use of the first column of Table 15 using the equivalent spiral angle. The first column, which gives deflections from a set-up on the $T.P._1$ is used regardless of the point of set-up since the spiral deflections desired are those from the *T.P.* of an equivalent simple transition. The circular curve deflections are computed for the curvature at the point of set-up as in method 2.

Examples 11.36. and 11.37. illustrate this method.

9. TRANSITIONS FOR REVERSE CURVES

9.1. It is of very great importance that transition curves should be inserted when two curves of opposite direction are in close proximity to one another.

Two cases will arise in Reverse Curves. They are :

Case I. Where the circular curves can be moved and the tangents are to be fixed.

Example 11.38. illustrates this case.

Case II. Where the circular curves are fixed and the tangents can be moved. Example 11.39. illustrates this case.

10. TRANSITIONS FOR HAIR PIN BENDS

10.1. A hair-pin bend may be designed as a circular curve with transition curves at each end. Alternatively, compound circular curves may be provided.

10.2. The following design criteria should be adopted normally for the design of hair-pin bends :

(a) Minimum design speed	... 20 km/h
(b) Minimum roadway width at apex	
(i) National/State Highways	... 11.5 m for double-lane ... 9.0 m for single-lane
(ii) Major District Roads / Other District Roads	... 7.5 m
(iii) Village Roads	... 6.5 m
(c) Minimum radius for the inner curve	... 14.0 m
(d) Minimum length of the transition	... 15.0 m
(e) Gradient	
Maximum	... 1 in 40 (2.5 per cent)
Minimum	... 1 in 200 (0.5 per cent)
(f) Superelevation	... 1 in 10 (10 per cent)

10.3. Inner and outer edges of the roadway should be concentric with respect to centre line of the pavement.

10.4. Where a number of hair-pin bends have to be introduced, a minimum intervening length of 60 m should be provided between the successive bends to enable the driver to negotiate the alignment smoothly.

10.5. Widening of hair-pin bends at a later date is a difficult and costly process. Moreover, gradients tend to become sharper, as widening can be achieved generally only by cutting the hill side. These points should be kept in view at the planning stage, specially where a series of hair-pin bends are involved.

10.6. At hair-pin bends, preferably the full roadway width should be surfaced.

10.7. A typical design worked out for hair-pin bend curve with the aid of table is given in Example 11.40.

11. WORKED OUT EXAMPLES

Example 11.1. Superelevation :

Design superelevation give the following particulars: Radius of curve 260 m; Classification of road M.D.R; The road runs in a very flat country in an embankment of 0.3 m; The surface of the road is B.T. and the road is in a gradient of 1 in 100.

Ruling Design speed for an MDR in flat country=80 km/h (from Table 2).

Minimum Radius of curve from Table 3 = 230 m (250 m is OK) Camber of *BT* surface from Table 5, 2 per cent

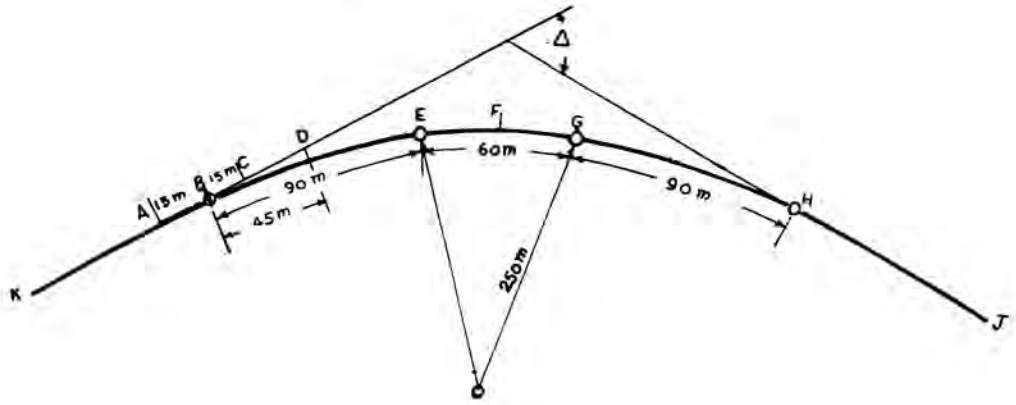
$$\text{Superelevation} = \frac{V^2}{225\,R}$$

$$= \frac{80 \times 80}{225 \times 250}$$

$$= 0.1137$$

Since this is more than 7 per cent allowable maximum superelevation, the superelevation to be provided is 7 per cent. Widening of road as per Table 7 = 0.6 m.

The length of the transition curve as per standards, (see Section 7. Table 9) equal 90 m. The maximum superelevation will, therefore, be attained at the end of the transition. The rise of the outer edge of road over the inner should be



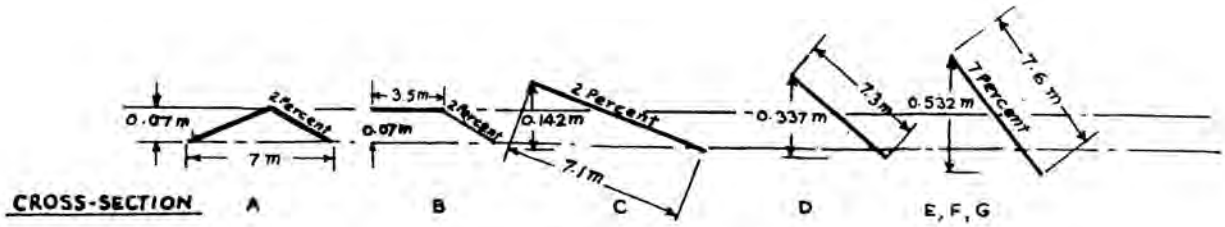


Fig. 26. Design of superelevation

$7.6 \times 0.07 = 0.532$ m for a carriageway width of (7 m + 0.6 m). So outer edge would be 0.266 m above the central line at the end of the transition.

So the differential grade due to superelevation = 0.266/90 = 0.0029

When the road is rotated about the central line the inner edge would be depressed by

$$0.266 - 0.02 \times \frac{7.6}{2} = 0.19 \text{ m}$$

So no drainage difficulties would be introduced as the embankment is 0.3 m high.

Fig. 26 shows the manner of attaining superelevation.

Example. 11.2. Transistion Curve :

Design a curve with transitions for a National Highway alignment in plain country for the following data :

Deviation angle $\Delta = 56°$

No restrictions in the field.

Ruling Design speed for a National Highway is 100 km/h (Table 2). Referring to Table 3 (page 12), the minimum desirable radius is 360 m.

As there are no restrictions choose a curve of 400 m radius.

Refer to Table 9 the minimum transition length is 115 m; since there are no restrictions 140 m is chosen.

$$\theta_s = \frac{L_s}{2\,R_c} \text{ radians}$$

$$= \frac{140}{2 \times 400 \text{ radians}}$$

$$= 0.175 \text{ radians} = 10.02673°$$

$$= 10° 1 \text{ m } 36 \text{ Sec}$$

Shift–Refer to Table 12 (Appendix 5)

Shift for unit length for $\theta = 10°$, = 0.0145

" for $\theta = 10.1°$ = 0.0147

Interpolation Shift for unit length for $\theta = 10.02673$ = 0.01455

$\therefore$ Shift for 140 m length = 0.01455×140

= 2.04 m

K for unit length of

transition for $\theta = 10°$, = 0.4995

" " $\theta = 10.1°$, = 0.4995

" " $\theta = 10.026°$ = 0.4995

$\therefore$ K for 140 m transition = $0.4995 \times 140 = 69.93$ m

$$T_s = (R_c + s) \text{ Tan } \frac{\Delta}{2} + K$$

$$= (400 + 2.04) \text{ Tan } \frac{56}{2} + K$$

$= 402.04 \text{ Tan } 28° + 69.93$
$= 402.04 \times .5317 + 69.93$
$= 213.76 + 69.93 = 283.695 \text{ m}$

$$E_s = \frac{(R_c + s)}{\text{Cos } \Delta/2} - R_c$$

$= 402.04 \times \text{sec } 28 - 400$
$= 402.04 \times 1.1326 - 400$
$= 55.350 \text{ m}$

LT for unit length for $\theta = 10°$ is 0.6677
" " $\theta = 10.6°$ is 0.6678
" " $\theta = 10.02073$ is 0.66773

LT for 140 m $= 0.66773 \times 140 = 95.48$ m
Similarly $ST = 0.3343 \times 140 = 46.802$
$LC = 0.99863 \times 140 = 139.81$ m

Example 11.3. : **Curve where the Apex distance controls the design**
Design a curve for the data given below :

Data : Design speed 40 km/hr
Nature of the country : Plain
Deviation angle : 56°

Apex distance limitation for the curve is between 20 m and 23.5 m for the site conditions, Fig. 27.

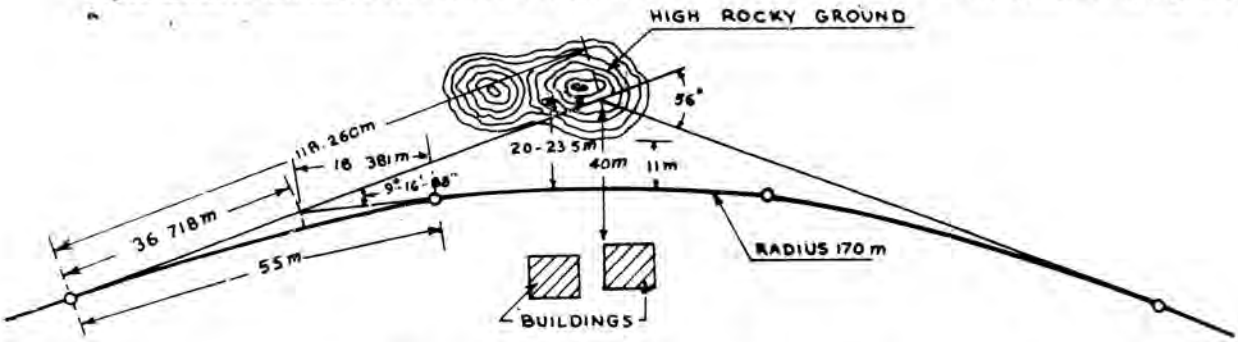


Fig. 27. Curve with apex distance limitations

From the Table 10 (Appendix 3) for $\Delta = 56°$, it is seen that the following combinations are suitable :

TABLE 11.1.

Radius (metre)	Length of Transition (metre)	E_s distance (metre)	Min. Transition Length (Table 9)
125 m	100	20.325	35 m
	120	21.963	
155 m	15	20.617	
	20	20.670	
	40	21.305	
	50	21.309	30 m
	80	22.492	
	100	23.582	
170 m	15	21.599	
	20	22.685	
	30	22.787	25 m
	55	23.376	

Since it is better to have the largest possible radius, the combination of 170 m for radius and 55m for L_s is chosen. This would give a T_s distance of 118.260 m and E_s of 23.376 m.

Important function of the transitions are calculated as follows :

$$\theta_s = \frac{L_s \times 28.65}{R_c} = \frac{55 \times 28.65}{170} = 9.269° \text{ m}$$

$$= 9°\text{–}16' 8.8"$$

s for unit transition from Table 12 (Appendix 5) for $\theta_s = 9.269°$

$\therefore$ for $L_s = 55$ m, Shift $= 0.013461 \times 55 = 0.74079$ from the same Table,

L.T. per unit transition for $\theta_s = 9.269°$ is 0.6676

S.T. ,, ,, $\theta_s = 9.269°$ is 0.3342

$\therefore$ L.T. and S.T. for 55 m transition are 36.718 m and 18.381 m respectively.

The other functions which are required for setting out the curve can be calculated from Table 11 (Appendix 4). In order to avoid calculations, ready made set-out tables have been worked out. The use of the Tables is explained under para 7.8.

Example 11.4 : Curve where Apex distance controls the design and the deviation angle is not a full degree

Design a curve for the data given in Example 11.3. when the deviation angle is 55° 42′ instead of 56°.

Inspection of the values of E_s figured for 55° and 56° shows that the curve with $R_c = 170$ m and $L_s = 55$ m will satisfy the requirements.

	T_s	E_s
Referring to Table 10 (Appendix 3)		
T_s and E_s for $\Delta = 55°$		
radius of curve 170 m and L_s of		
55 m are	116.358	22.490
E_s for $\Delta = 56°$ for a radius		
170 m and L_s of 55 m are	118.260	23.376
Difference for one degree	1.902	0.886
$\therefore$ Difference for 42 minutes	1.3314	0.620

T_s and E_s for $\Delta = 55°\ 42'$ are 107.689 m and 23.11 m respectively.

The functions of the transition are the same as worked out in Example 11.3.

Example 11.5 : Curve where Apex distance is equal to a given value

Design a curve with data given in Example 11.3: with E_s distance exactly equal to 21.75 m.

Inspection of the E_s values given in Table 10 (Appendix 3) for $\Delta = 56°$ shows that the following combinations will satisfy the requirements :

(1) Radius 155 m with transition between 60 m and 65 m

(2) Radius between 155 m and 170 m and transition length between 40 m and 60 m.

It is also seen that a curve with a radius of 170 m and a transition length as small as 40 m has a E_s value of 22.981 m which is greater than that required. Thus the possible solutions are the numerous combinations of radius below 170 m and transition lengths mentioned in (2) above and the curve mentioned in (1) above.

Solution for (1) : $R_c = 155$ m

$$E_s = \frac{(R_c + s)}{Cos \frac{\Delta}{2}} - R_c$$

$$\therefore \quad 21.75 = \frac{155 + s}{Cos\ 28°} - 155$$

$$21.75 = 155\ (sec\ 28° - 1) + s.\ sec\ 28°$$
$$= 155\ (1.1326 - 1) + 1.1326\ s$$
$$= 20.533 + 1.1326\ s$$

$$\therefore \quad s = \frac{21.75 - 20.535}{1.1326} = 1.0568 \text{ m}$$

$\therefore$ a transition curve with 155 m radius and s equal to 1.057 m will give E_s value = 21.75 m

$s = 1.057$ m

$$\frac{s}{R} = \frac{1.057}{155} = 0.0068$$

Refer Table 12 (Appendix 5) under column $\frac{s_x}{R}$

A curve with $\theta_s = 11.6°$ satisfied the requirements. Referring to the same table, the radius at the end of the spiral for a unit length of transition is 2.4696.

Since the radius of the curve to be designed is 155 m, the length of the transition will be $= \frac{155}{2.466} = 62.8548$ m. So a transition length of 62.8548 with a radius of curve equal to 155 m will have a $E_s = 21.75$ m.

Solution for condition (2)

Inspection of the values for E_s for $\Delta = 56°$ in Table 10 (Appendix 3) shows that for any given value of E_s greater radius of curve could be had when the length of the transitions adopted are short. For example in the case under consideration, if $L_s = 60$ m is used the radius of curve that will be had is about 155 m whereas if a transition of 40 m is used, a curve of greater radius will result. Since it is desirable to have as large a radius as possible within the limitations of the site, a transition curve with a length L_s of 40 m minimum required will be preferred to all others.

$$E_s = \frac{(R_c + s)}{Cos \frac{\Delta}{2}} - R_c = R_c\ (sec \frac{\Delta}{2} - 1) \times s\ sec \frac{\Delta}{2}$$

In the above formula, $\Delta = 56°$ $E_s = 21.75$ m R_c and s are not known. Even though L_s is equal to 40 m the shift value of the transition depends on the radius of curve which is sought to be found out. So the problem is solved by trial and error.

Try $R_c = 160$ m

$$\theta_s = \frac{28.65 \times 40}{160} = 7.1625°$$

Shift for unit transition of this (see Table 12—Appendix 4) = 0.010425

$\therefore$ Shift = $0.010425 \times 40 = 0.417$ m

$\therefore E_s = (160 + 0.417)\ 1.1326 - 160 = 21.688$ m
(This is less than required)

So try 162 and 165 m which are likely to be nearer the desired value.

R_c	θ_s	s per unit length	s per 40 m	E_s
162	7.074°	0.01027	0.410	21.9466 m
165	6.945°	0.0101	0.404	22.33 m
161	7.118°	0.010336	0.413	21.8168 m

The curve with a radius 160 m will result in an E_s differing from the required by 0.062 m only and may be adopted.

Example 11.7. When the tangent distance controls design

Design a curve on a National Highway given
Nature of country — Plain
Deviation angle — 56°

Site conditions require that the T_s distance should be between 300 m and 322 m because of a level crossing, Fig. 28. From the Table 10 (Appendix 3) for $\Delta = 56$, it is seen that the following combinations of R_C and L_S satisfy the requirements the values to the right of the zig-zag line for speed of 100 km/hr being applicable for $N.H_S$. in plain country.

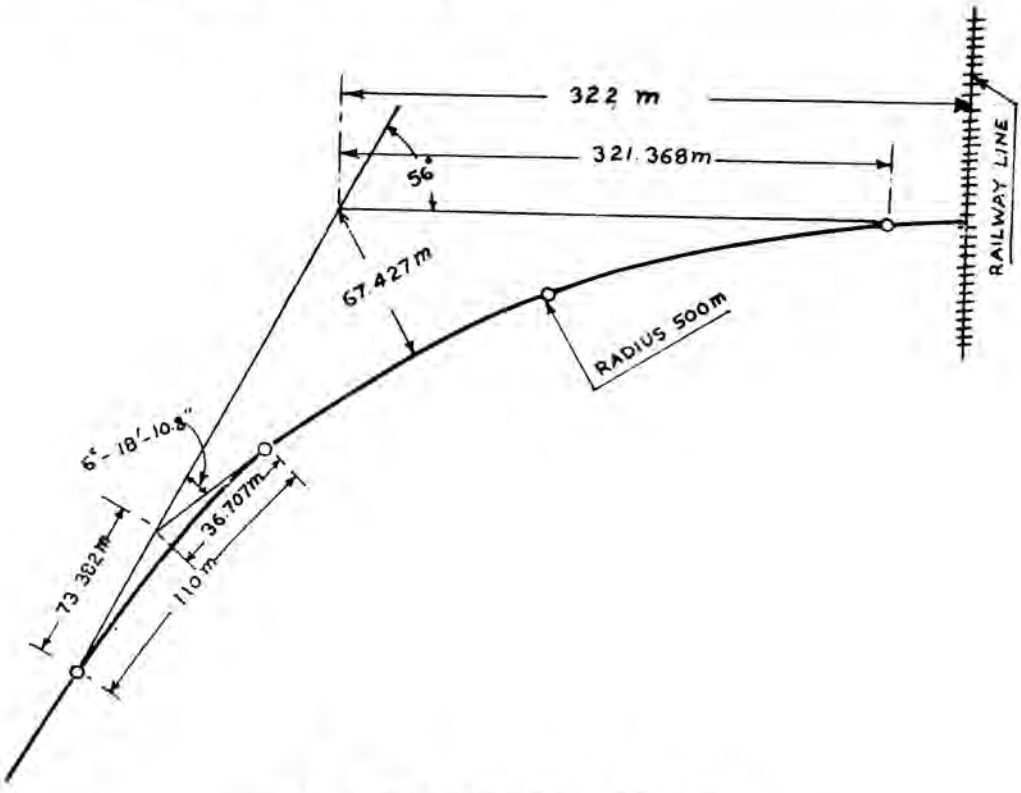


Fig. 28. Curve with fixed tangent distance

TABLE 11.2.

Rc (metre)	Ls (metre)	Ts (metre)	Es (metre)
360	140	262.532	50.291
400	140	283.697	55.338
	130	278.562	55.020
	120	273.436	54.720
500	120	326.463	67.694
	110	321.368	67.427
	105	318.823	67.325

Since it is desirable to go in for as large a radius as possible, a radius of 500 m and Ls 110 m is chosen. This gives a Ts distance of 321.368 m and Es = 67.427 m. Other values for the transition curve are worked as in Example 11.3.

$$\theta_s = \frac{Ls \times 28.65}{R} = \frac{110 \times 28.65}{500} = 6^\circ - 18' - 10.8''$$

LT = 73.381, ST = 36.707 m, s = 1.012 m

Example 11.8. When the tangent distance controls the design with a deviation angle which is not a whole degree

Design a curve for data given in Example 11.7. when the deviation angle is 55°—42′—0″.

Inspection of the Ts value for Δ = 55° in Table 10 (Appendix 3) shows that a combination of 500 m for R_c and 110 m for L_s is likely to give a value for T_s within the specified range, namely, 300 m and 322 m.

So from Table 10 (Appendix 3)

T_S for Δ 55°, R_c = 500 m and L_S = 110 m		=	315.786
T_S for Δ 56°,	,, ,,	=	321.368
	Difference for 60′	=	5.582
	,, 42′	=	3.907

$\therefore$ T_S for 55°—42′ is 315.786 + 3.907 = 319.693 m

This falls within the range.

Since the transition length and R_C are the same as in Example 11.7. the transition curve functions also are the same.

Example 11.9. Curve for a tangent distance is exactly equal to a given value

Design a curve for the data given in Example 11.7, when T_S = 350 m exactly.

$$T_S = (R_C + s) \tan \frac{\Delta}{2} + K$$

$$\therefore \quad 350 = R_C \tan 28^\circ + s \tan 28^\circ + K$$

Inspection of Table 10 (Appendix 3) for $\Delta = 56°$ shows that the following combinations will be suitable:

	R_C	L_S
(1)	500 m	Between 15 and 140 m
(2)	600 m	Between 15 and 60 m
(3)	Combinations of R_C between 500 m and 600 m	and L_S between 60 m and 140 m

As the classification of the Highway in which the curve is to be put in is a *N.H.*, as per Table 9, the transition L_S less than 95 and 80 m are not suitable for curves of radii 500 and 600 m respectively. Since it is desirable that the largest possible R_C should be aimed at all the combinations (1), (2) and (3) mentioned above do not apply. So the problem narrows down to one of selecting a Ls greater or equal to 95 m for a radius between 500 m and 600 m.

T_S for $R_C = 500$ m and $L_S = 95$ m is 313.740

T_S for $R_C = 600$ m and $L_S = 95$ m is 366.849

Difference = 53.109

Interpolating by inspection $R_C = 568$ is likely to give a $T_S = 350$ m with an $L_S = 95$ m.

TABLE 11.3.

R_c	$R_c \tan 28°$	For $L_s = 95$ m and radius equal to R_c			
		θ_s	s	$s \tan 28°$	K
565	300.41	4.817	0.666	0.3544	47.4905
568	302.00	4.791	0.663	0.3526	47.4905
570	303.069	4.775	0.660	0.3550	47.4905

The values of $s \tan 28°$ and K are constant for small changes in R_c since the values of θ_s is very small.

To find the exact value of the R_c

$\therefore 350 = R_c \times \tan 28° + 0.35 + 47.49$

$\therefore R_c \tan 28° = 350 - 47.84$

$= 302.16$

$$\therefore R_c = \frac{302.16}{\tan 28°} = \frac{302.16}{0.5317} = 568.29 \text{ m}$$

The curve required has an $R_c = 568.29$ and

$L_s = 95$ m

Example 11.10. A fully transitioned curve for a specified range of apex distance

Design a curve for the data given in Example 11.3. Referring to Table 13, the apex distance for a curve $L_s = 100$ m for $\Delta = 56°$ is 18.137. To get a $E_s = 20$ to 23.5 m.

$$L_s = \frac{100}{18.137} \times 20 \text{ to } 23.5 = 110.27 \text{ to } 129.57$$

Assume $L_s = 120$ m

For this curve $\theta_s = \frac{56}{2} = 28°$

$$\theta_s = \frac{L_s \times 28.65}{R_c}$$

$$\therefore 28° = \frac{120 \times 28.65}{R_c}$$

$$\therefore R_c = \frac{120 \times 28.65}{28} = 122.79 \text{ m}$$

The functions of the transition L.T. S.T. etc., are calculated by multiplying the appropriate values in Table 12 (Appendix 5) for $\theta = 28°$ by the length of the transition. For values of Δ which are not whole degrees, the values figured in Table 13 are interpolated.

Example 11.11. Fully transitioned curve for an apex distance equal to a given value

Design a curve for the data given in Example 11.5. i.e $E_s = 21.75$ m

From Table 13, E_s for $L_s = 100$ m for $\Delta = 56°$ is 18.137

Since the curve is transitional throughout the $\theta_s = 28°$

For a given θ_s when the L_s increases all the other functions increase proportionately.

$$\therefore L_s \text{ required} = \frac{100}{18.137} \times 21.75 = 119.92 \text{ m}$$

$$R_c \text{ of the curve} = \frac{119.92 \times 28.65}{28} = 122.704 \text{ m}$$

Two transition curves of radius 122.704 m and length of 119.92 m will result in a fully transitioned curve with an $E_s = 21.75$ m.

From Table 13, T_s of the curve is $\frac{199.92}{100} \times 106.153 = 127.298$ m.

Example 11.12. Design a transition curve given the radius R_c and s.

$R_c = 100$ m, $s = 0.25$ m

$$\therefore \frac{s}{R_c} = \frac{0.25}{100} = 0.0025$$

Referring to Table 12 (Appendix 5), θ_s corresponding to the value of 0.0025 for $\frac{s_s}{R}$ is 7.0

$\therefore \theta_s$ for the required curve $= 7°$

R for unit length of transition and $\theta_s = 7°$ is 4.0926

$$\therefore L_s = \frac{100}{4.0926} = 24.434 \text{ m}$$

Or alternately

Shift for unit L_s and $\theta_s = 7°$ is 0.0102

$$\therefore L_s = \frac{0.25}{.0102} = 24.509 \text{ m}$$

Referring to Table 12 (Appendix 5) L.T. $= 0.6672 \times 24.5 = 16.346$ m

S.T. $= 0.3338 \times 24.5 = 8.178$ m

Example 11.13. Design a transition curve with its Y_c and R_c equal to a specified value

$Y_c = 3$ m

$R_c = 250$ m

$Y_c/R_c = \frac{3}{250} = 0.012$

From Table 12 (Appendix 5) θ with a value of 0.012 for Y/R is 7.7°

R for a value of $\theta = 7.7°$ and $L_s = 1$, is 3.7205

$\therefore$ L_s for the required curve is $\frac{250}{3.7205} = 67.195$ m

The other functions of the curve are obtained by multiplying the values given in Table 12 (Appendix 5) for 7.7° with 67.195 m

$s = 0.0112 \times 67.195 = 0.753$ m

L.T. $= 0.6673 \times 67.195 = 49.84$ m

S.T. $= 0.3339 \times 67.195 = 22.44$ m

Example 11.14. Design a transition curve with specified values for its radius and short tangent

$R_c = 250$ m

S.T. $= 20$ m

$\frac{R_c}{\text{S.T.}} = \frac{250}{20} = 12.50$

By inspection of Table 12 (Appendix 5) find out the value of θ which will yield a value of $\frac{R_c}{\text{S.T.}} = 12.50$

θ	R	$S.T.$	$R/S.T.$
6.8	4.2129	0.3338	12.621
6.9	4.1519	0.3338	12.438
7.0	4.0926	0.3338	12.26

Interpolating

$\therefore$ θ_s for $\frac{R}{S.T.} = 12.50$ is 6.866°

Value of R for unit L_s for $\theta = 6.866°$

R for $\theta = 6.8°$ (from Table 12, Appendix 5) $= 4.2129$

R for $\theta = 6.9°$,, ,, $= 4.1519$

For a difference 0.1° $= 0.0610$

$\therefore$,, 0.066° $= 0.0403$

For $\theta = 6.866°$ $R = 4.2129 - 0.040 = 4.1726$

$\therefore$ L_s required $= \frac{250}{4.1720} = 59.914$ m

Referring to Table 12 (Appendix 5)

L.T. $= 0.6672 \times 59.914 = 39.975$ m

S.T. $= 0.3338 \times 59.914 = 19.999$ m

Example 11.15. Design a curve with a specified value for E_s and R/L

For the data given in Example 11.5. with $R/L = 4$ refer to Table 12 (Appendix 5). The last coluumn R gives the values of the radius for a curve of unit length.

Find out the θ which gives a value of 400 for R

For	θ_s	R
	7.1	4.0349
	7.2	3.9789
Difference	0.1	0.0560

$\therefore$ for 0.0349 difference $\frac{0.1}{0.0560} \times 0.0349 = .0623$

$\therefore$ $R/L = 4.00$ for a $\theta_s = 7.1623°$

$$E_s = (R_c + s)\ sec.\ \frac{\Delta}{2} - R_c$$

$$= R_c\ (sec.\ 28° - 1) + s\ sec.\ 28°$$

$$= R_c \times 0.1326 + 1.1326\ s$$

If L_s is the length of the transition $R_c = 4\ L_s$,

$\theta_s = 7.1623°$ and required $E_s = 21.75$ m

$\therefore$ $21.75 = 4 \times L_s \times 0.1326 + 1.1326 \times L_s \times 0.0104$

$$21.75 = L_s\ (4 \times 0.1326 + 1.1326 \times 0.0104)$$

$$= L_s\ (0.5304 + 0.01178)$$

$$= L_s \times 0.5422$$

$$\therefore\ L_s = \frac{21.75}{0.5422} = 40.114 \text{ m}$$

$$R_c = 4 \times 40.114 = 160.457 \text{ m}$$

Referring to Table 12 (Appendix 5)

K for $\theta_s = 7.1623$ and unit L_s is 0.4997

K for $L_s = 40.114$ is $0.4997 \times 40.114 = 20.0449$ m

s for $L_s = 1$ and $\theta = 7.1623$ is 0.0104

$\therefore$ for $L_s = 40.114$, $s = 0.0104 \times 40.114 = 0.41718$ m

$$T_s = (R_c + s)\ \tan\ \frac{\Delta}{2} + K$$

$$= (160.457 + 0.41718)\ 0.5317 + 20.0449$$

$$= 105.582 \text{ m}$$

L.T. $= 0.6672 \times 40.114 = 26.764$ m

S.T. $= 0.3338 \times 40.114 = 13.390$ m

Example 11.16. Design a transition spiral to pass through a specified point

R_c = 250 m; The curve is to pass through a point at a distance of 2.5 m from the tangent at a distance of 80 m from the start of the curve, Fig. 29.

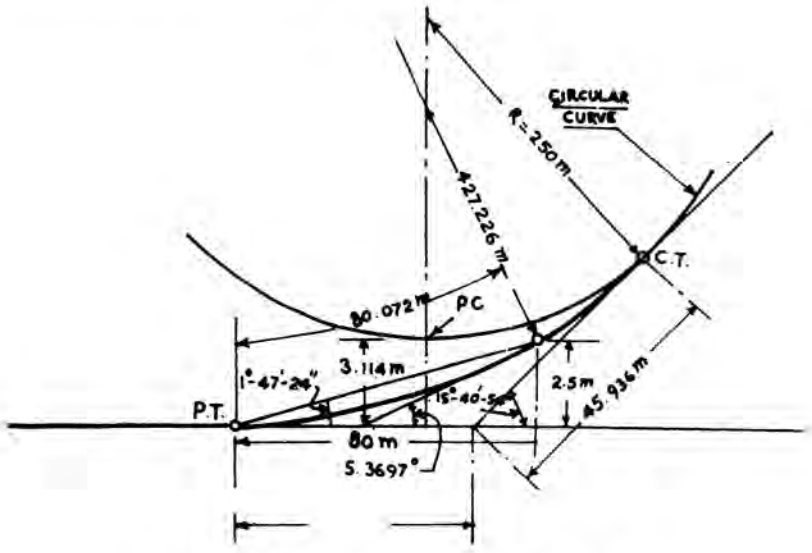


Fig. 29. Transition passing a specified point

$$\alpha = tan^{-1}\frac{2.5}{80} = tan^{-1}\,0.03125$$

$$= 1.7899^\circ = 1^\circ\,47'\,24''$$

θ is 3 times the polar deflection angle and no correction is necessary, as the angle is small.

$$\therefore\ \theta = 3 \times 1.7899^\circ = 5.3697^\circ$$

From Table 12, (Appendix 5) x for $\theta = 6.4425^\circ$ and unit L_s, is 0.9991

$$\therefore\ L \text{ at the point where } x = 80 \text{ m is } \frac{80}{0.9991} = 80.07\,\text{m}$$

R for $L_s = l$ and $\theta = 5.3$ is 5.4053

R for $L_s = l$ and $\theta =$	5.4 is	5.3052	
Difference	0.1	0.1001	
For ,,		0.0697	= 0.06976

$\therefore\ R\,\theta_s = 5.3697$ and $L_s = l$, is 5.3355

$\therefore$ When L is equal to 80.072 m, Radius is $5.3355 \times 80.072 = 427.226$ m

$\therefore\ L_s \times 250 = 80.072 \times 427.226$ since $R \times L$ = constant

$\therefore\ L_s = 136.836$ m

$$\left(\frac{L}{L_s}\right)^2 = \frac{\theta}{\theta_s};\ \left(\frac{80.072}{136.836}\right)^2 = \frac{5.3697}{\theta_s}$$

$$\theta_s = 15.6815^\circ$$

$$= 15^\circ\,40'\,54''$$

Referring to Table 12 (Appendix 5)

$s = 0.02276 \times 136.836 = 3.114$ m

$L.T. = 0.6693 \times 136.836 = 91.584$ m

$S.T. = 0.3357 \times 136.836 = 45.936$ m

Example 11.17. Field set when offsets are measured from main tangent

Set out a transition with a radius of curve 170 m and a length of 55 m (see Example 11.3.)

Referring to Table 11 (Appendix 4) values of X_1, X_2, X_3, ...X_{10} viz., 5.5, 11, 16.5....., 54.856 m are measured along the main tangent. Offsets equal to Y_1, Y_2,..... Y_{10} viz., 0.003, 0.024..... ...2.96 m are measured at the points X_1, X_2, ...X_{10}, etc. giving points X_1, Y_1; X_2, Y_2;.....X_{10}, Y_{10}. The line joining the 10 points so laid out is the transition required, Fig. 30. The *L.C.* of the curve viz. 54.936 m is measured from X_{10}, Y_{10} or *C.T.* to *TP* as a check. A distance 36.717 m equal to *L.T.* of the curve is measured along the tangent. The line joining this point with the *C.T.* is the short tangent. The length of this should be equal to 18.379 m. The short tangent may be produced and the circular curve laid out in the usual manner.

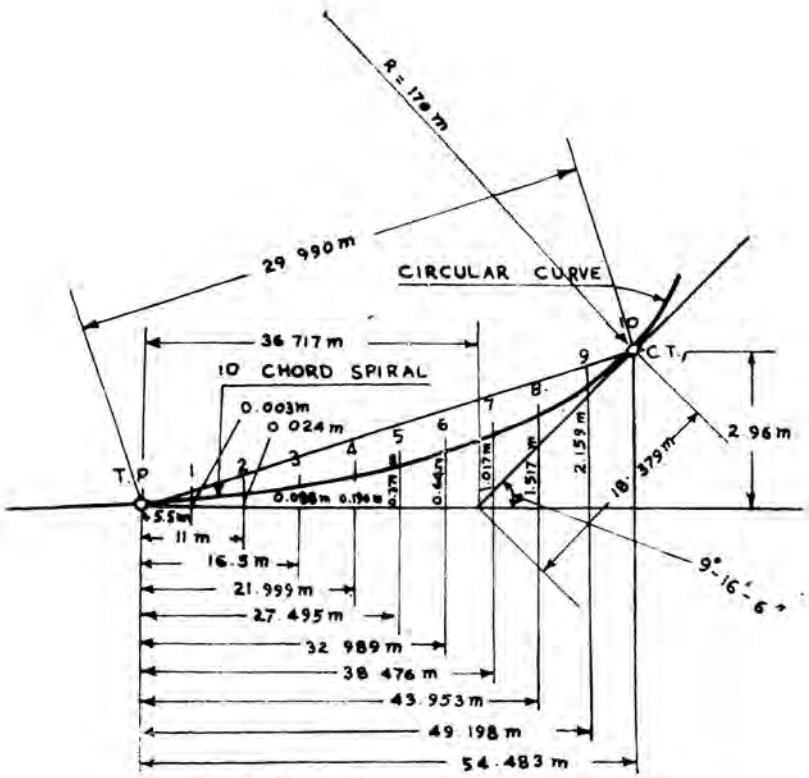


Fig. 30. Field set off measured from main tangents

Example 11.18. Field set out when offsets cannot be measured from the main tangent

Set out a curve with a radius 170 m and length of transition of 55 m when offsets cannot be measured from the main tangent beyond the first 5 points of the 10-chord spiral.

First half of the curve is laid out as described in Example 11.17. with offsets from the main tangent, Fig. 31.

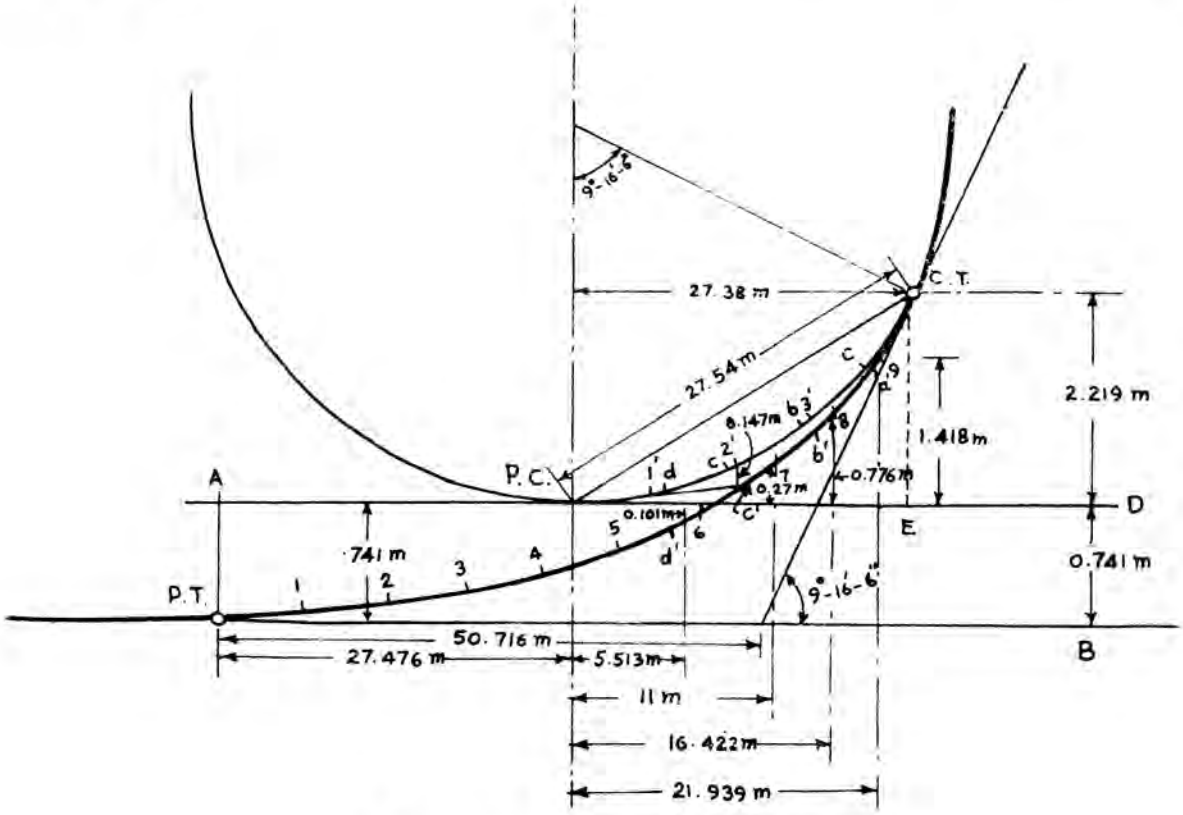


Fig. 31. Field set out away from main tangent

Refer to Table 11 (Appendix 4) and read the following values :

$K = 27.476$ m

$s = 0.741$ m

$\theta_s = 9°-16'-6''$

X_6	Y_6	X_7	Y_7	X_8	Y_8	X_9	Y_9	X_{10}	Y_{10}
32.989	0.64	38.476	1.017	43.953	1.517	49.415	2.159	54.856	2.96

$LC = 54.936$ $L.T. = 36.717$ $S.T. = 18.379$ Measure $K = 27.476$ m along the main tangent and at the point, erect a perpendicular equal to 0.741 m. The point so obtained is PC. At PT the start of the curve, erect a perpendicular equal to 0.741 m. Join this point with the PC. The resulting line is parallel to the main tangent. At any other convenient point B on the main tangent, erect a perpendicular equal to 0.741 m. Join the point D so obtained with PC. A—(PC)—D is a straight line parallel to the main tangent. The offsets from this line are calculated as follows :

Offsets from main tangent	X_6	Y_6
	32.989	0.64

Offsets from line A—(PC)—D, with $P.C.$ as for origin X'_6 and Y'_6 are

$X'_6 = 32.989 - 27.476 = 5.513$ m and $Y'_6 = 0.64 - 0.741 = -0.101$ m respectively.

Similarly X'_7, Y'_7, X'_8, Y'_8, X'_{10}, Y'_{10} are worked out and tabulated in Table 11.4.

TABLE 11.4.

X'_6	Y'_6	X'_7	Y'_7	X'_8	Y'_8	X'_9	Y'_9	X'_{10}	Y'_{10}
5.513	−0.101	11 m	+0.276	16.477	+0.776	21.939	+1.418	27.38	+2.219

Alternate method of laying by offsets from the osculating circle at CT. The osculating circle is laid out by any one of the standard methods. Laying it by the extended chord method is given below.

Let PC.E be the tangent to the circle at PC parallel to the main tangent. Let CT.E be the perpendicular to the tangent. Distance PC.E is 54.856—27.476 = 27.38 m. So choose 5 m chords. The first offset from the tangent to point 1′ is equal to $\frac{1^2}{2R} = \frac{25}{2 \times 170} = 0.0735$ m. Extend the chord PC1′ and by means of a tape on a rod/arrow swing a length of 5 m about the point 1′ by distance equal to $\frac{L^2}{R} = \frac{25}{170} = 0.147$ m. The resulting point is point 2′ on the curve. Other points can be set similarly.

CT on the curve is fixed either by measuring the distances PCE = 27.38 m and C.T.E. = 2.219 m or the distance PC.CT $= 2 \times 170 \times \sin \frac{9°-16-6'}{2} = 27.59$ m

Distances equal to one chord of the spiral namely 5 *m* are measured along the circle from the CT. These points are *a,b,c,d* and *e*. Then measure *aa′*, *bb′*, *cc′*, *dd′* and *ee′* equal to the offsets of the spiral to points 1,2,3,4 and 5 from the tangent namely 0.003, 0.024, 0.080, 0.190, 0.371 m respectively normal to the circular curve. The line joining *a′b′c′d′* and *e′* is the required spiral.

Example 11.19. Set out of a transition with odd values for its length

Set out the transition as below :

$L_s = 58.468$ m, $R_c = 125$ m, $E_s = 21.75$ m

$\theta_s = \frac{L_s \times 28.65}{R_c} = \frac{58.468 \times 28.65}{125} = 13.4°$

Step 1

Calculate $\theta_1, \theta \ldots\ldots \theta_9$ to points 1,2,.....9 of the 10-chord spiral by using the coefficients given in Table 14 (page 41)

$\theta_1 = 13.4 \times .01 = 0.134$

$\theta_2 = 13.4 \times .04 = 0.536$

$\theta_9 = 13.4 \times 0.81 = 10.854$

Step 2

Calculate the co-ordinates $X_1\ Y_1$, $X_2\ Y_2 \ldots\ldots X_9\ Y_9$ for the 10-chord spiral by using the coefficients for X & Y for $L_s = 1$ given in Table 12 (Appendix 5) for the corresponding θ value. The length of the spiral up to the point for which the value is calculated should be used in the calculation. Thus for θ_1 referring to Table 12 (Appendix 5).

$X = 1.0000 \qquad Y = 0.00078$

Length of the spiral $= 5.8468$ m

$\therefore X_1 = 5.8468$ m and $Y_1 = 5.8468 \times 0.00078 = 0.0046$ m

Similarly for $\theta_9 = 10.854$ referring to Table 12 (Appendix 5)

$X = 0.9964$ $Y = 0.06321$

$\therefore X_9 = 0.9964 \times 5.8468 \times 9 = 52.434$ m

$Y_9 = 0.6321 \times 5.8468 \times 9 = 3.326$ m

Similarly the values are calculated for other points and are given in Table 11.5. and Fig. 32

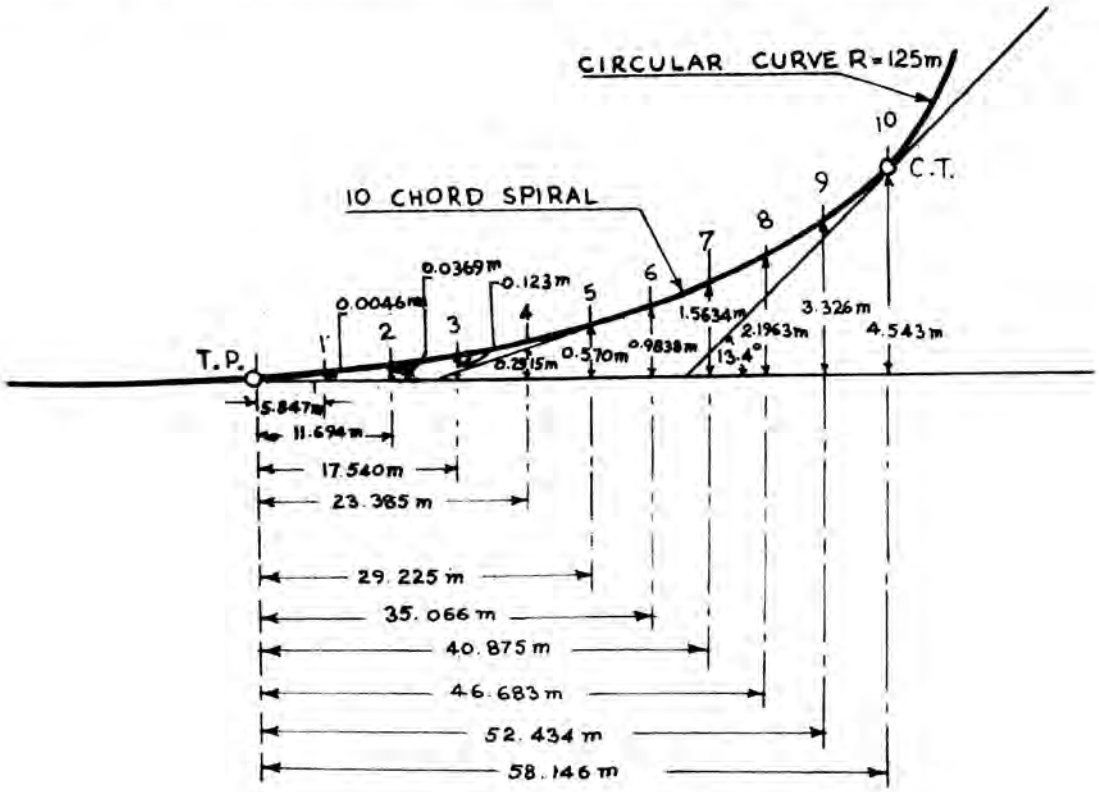


Fig. 32. Field set out with odd value of transition length

TABLE 11.5.

Chord Point	Length to chord point from start of curve	θ to the chord point	Coefficient reads from Table 12 (Appendix 5)		X	Y
			X	Y		
1	5.847	0.134	1.0000	0.00078	5.847	0.0046
2	11.694	0.536	1.0000	0.00312	11.694	0.0364
3	17.540	1.206	1.0000	0.00704	17.540	0.1234
4	23.387	2.144	0.9999	0.01246	23.385	0.2915
5	29.239	3.350	0.9997	0.0195	29.225	0.5700
6	35.081	4.824	0.9993	0.0280	35.056	0.9838
7	40.928	6.566	0.9987	0.0382	40.875	1.5634
8	46.774	8.576	0.99805	0.0469	46.683	2.1963
9	52.621	10.854	0.9964	0.0632	52.434	3.236
10	58.468	13.4	0.9945	0.0777	58.146	4.543

Example 11.20. Calculations for quarter-point method

Length of curve = 58.468 m

$$R_c = 125;\ \theta_s = \frac{L_s \times 28.65}{R_c}$$

$$= 58.468 \times \frac{28.65}{125}$$

$$= 13.4°$$

X_c and Y_c for unit length of transition from Table 12 (Appendix 5) are equal to 0.9945 and 0.0777. Therefore, X_c and Y_c are equal to 58.146 m and Y_c is equal to 4.543 m.

The values to other points are calculated as in Table 11.6, Fig. 33.

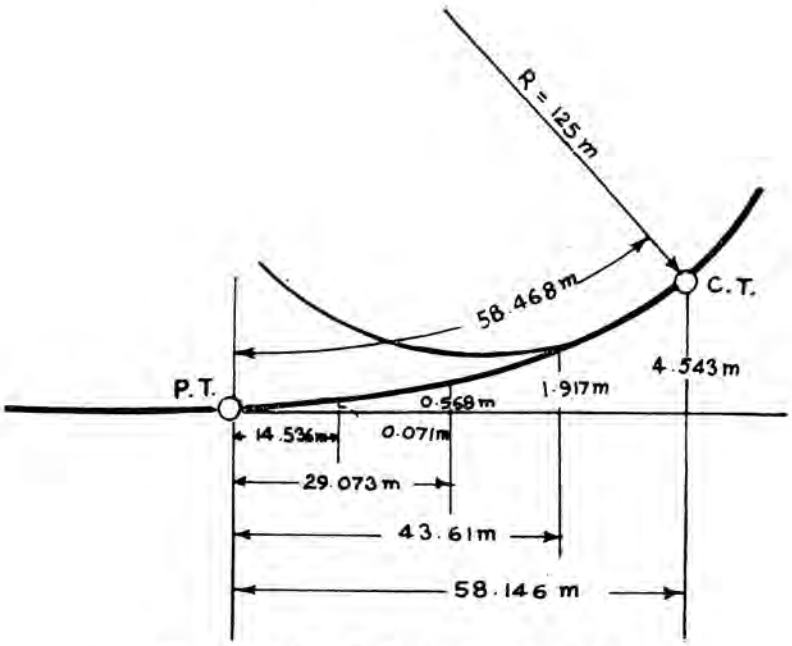


Fig. 33. Field set out by quarter-point method

TABLE 11.6.

	CT	1/4 Point	1/2 Point	3/4 Point
Coefficient of X	1	1/4	1/2	3/4
Coefficient of Y	1	1/64	1/8	27/64
Value of X	58.146	19.536	29.073	43.61
Value of Y	4.543	0.071	0.568	1.917

Example 11.21. Calculations for set out by polar deflection angles

Set out the transition designed in L_s = 55 m R_c = 170 m, Δ = 56°. Therefore the curve chosen is a standard one. Refer to Table 11 (Appendix 4) and range the curve described in para 7.9.6. The values of α_1' α_2' etc. are 0–1'–51", 0–7'–24" etc. Length of chord is equal to, 5.5 m, Fig. 34. Check the point C.T. by using values of L.T. and S.T. and θ_s figured in Table 11 (Appendix 4).

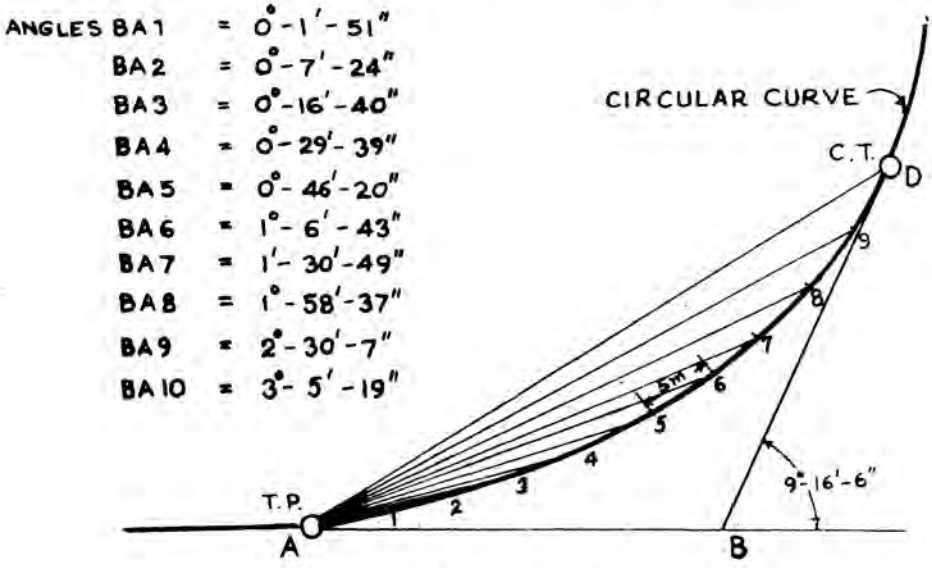


Fig. 34. Field set out by polar deflection

Example 11.22. Calculations for polar deflections when the length of spiral is equal to an odd distance from T.P.

Set out the transition designed, L_s = 58.468 m, R_c = 125 m and

$$\theta_s = \frac{L_s \times 28.65}{125} = 13.4°$$

The polar deflections are calculated as in Table 11.7; Fig. 35.

TABLE 11.7.

	Station Point									
Instrument sighted to...from T.P.	1	2	3	4	5	6	7	8	9	10
Coefficient from Table 14 (page 41)	0.0033	0.0133	0.030	0.0533	0.0833	0.1200	0.1633	0.2133	0.2700	0.3333
Polar deflection from T.P.–13.4° × Coefficient	0.044	0.17822	0.402	0.7142	1.1162	1.608	2.1882	2.858	3.618	4.466
Polar deflection angle in degrees, mins. and secs.	0° 2' 39.2"	0° 10' 41.60"	0° 24' 7.2"	0° 42' 51.2"	1° 6' 58.4"	1° 36' 28.8"	2° 11' 17.6	2° 51' 29.6"	3° 37' 4.8"	4° 27' 58.4"

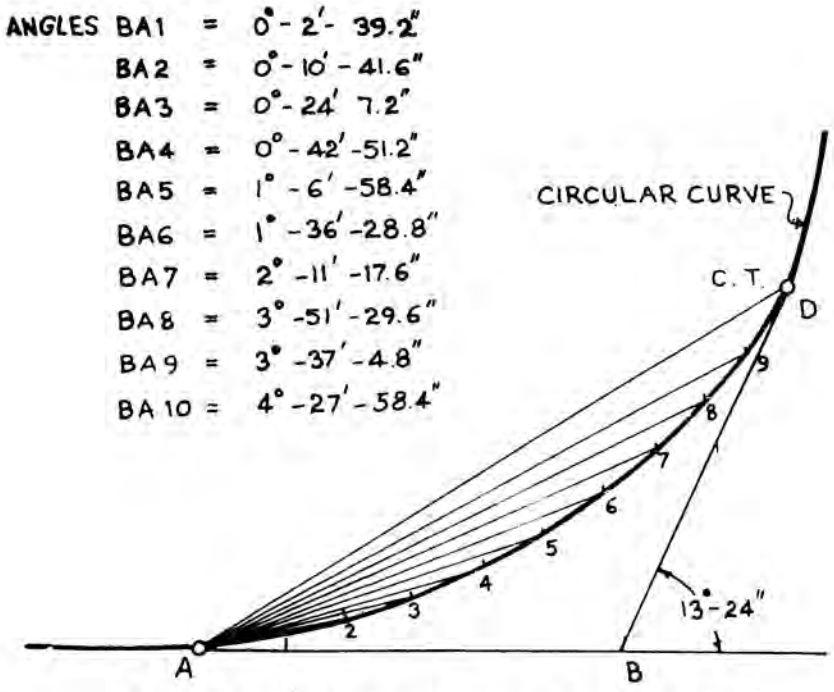


Fig. 35. Field set out by polar deflections for odd lengths

Example 11.23. Calculations for polar deflections for odd values of L for set out from the C.T.

When part of the transition is not visible from the T.P. the start of the curve, the instrument may be shifted to C.T. i.e., end of the transition and the transition laid from that point. Example below illustrates the calculations for the set out of the whole transition from the C.T.

Set out the transition designed in Example 11.5. from the C.T. If the TP is visible from the C.T. with the reading of the instrument set to (Table 15, Col. 3) = 11.6° × 0.6667 = 7.733° i.e. 7°–44'–1" sight to TP. Turn the instrument with the top plate unclamped to zero. The line so ranged is the tangent at C.T. or the short tangent. Check by measuring the LT along the main tengent.

LT = 0.6673 × 62.8548 = 41.943 m (from Table 12, Appendix 5). The polar deflections to point 9,8,7..... 1 are calculated by multiplying θ_s with the appropriate co-efficient in column (13) of Table 14 (page 41). The values are given in the Table 11.8. and Fig. 36.

$$\theta_s = \frac{62.8548 \times 28.65}{155} = 11.62°$$

TABLE 11.8.

Instrument sighted to points..... from C.T.	Station point									
	9	8	7	6	5	4	3	2	1	T.P.
Coefficient from Table 14 (page 41)	0.0967	0.1867	0.2700	0.3467	0.4167	0.4800	0.5367	0.5867	0.6300	0.6667
Polar deflections θ_s × coefficient	1.123°	2.169°	3.137°	4.028°	4.842°	5.577°	6.246°	6.817°	7.32°	7.733°
Polar deflection in degrees, mins. and secs.	1° 7' 22.8"	2° 10' 10"	3° 8' 14.6'	4° 1' 43.5"	4° 5' 31.39"	5° 34' 39.36"	6° 14' 48.88"	6° 9' 2.83"	7° 19' 14"	7° 44' 1"

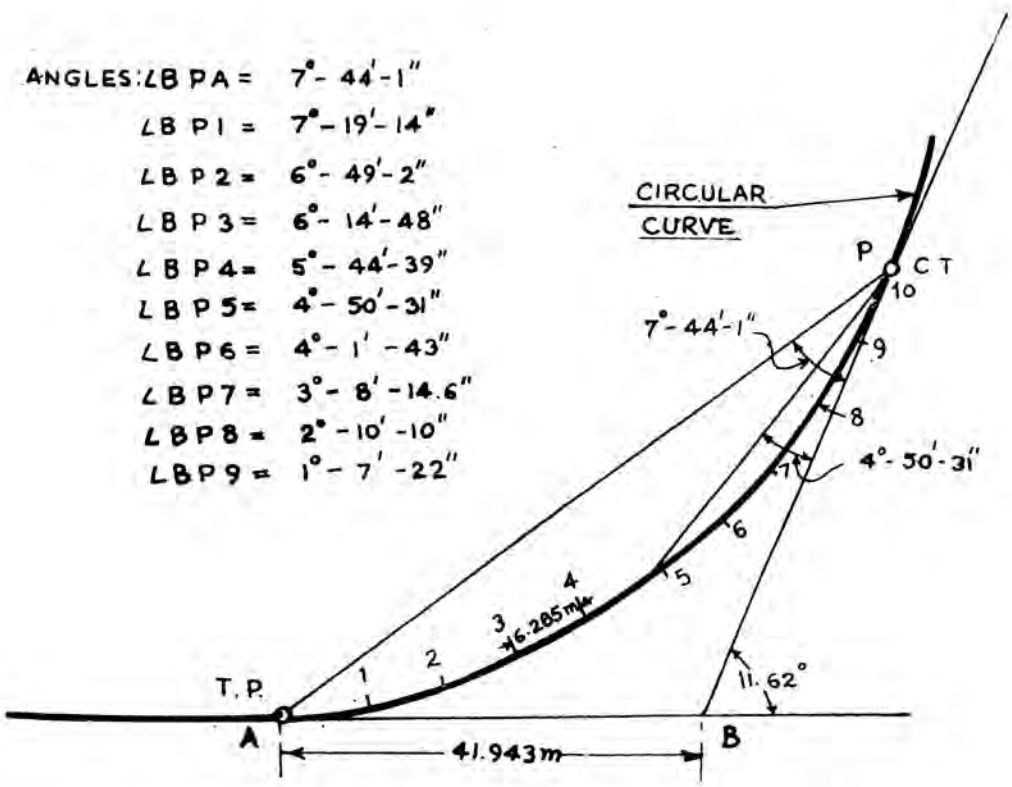


Fig. 36. Polar deflections for odd values of *Ls* and backward set out

Example 11.24. Calculations for set out by polar deflections when instrument shift to an intermediate station is necessary

If a part of the transition is not visible either from the start or the end of the curve, the instrument will have to be shifted to an intermediate point and new set up of polar deflection angles worked out. Set out the curve designed in Example 11.5. when shifting of the instrument is necessary to point 6.

$\theta_s = 11.62°$

$L_s = 62.8548$ m

$R_c = 155$ m

Set out the curve upto the point visible, i.e., point 6 as described in Example 11.22. The instrument is then shifted to point 6 as point 7 is not visible from *TP*. The first step is to range the tangent to the curve at point 6.

So $\angle$ *PT—6—A* is first calculated, Fig. 37.

Refer to Table 14 (page 41) the coefficient against 0 point in column (9) with instrument at point 6 is 0.240.

$\therefore \angle PT.6.A = 0.24 \times 11.62 = 2.788° = 2° -47'-20"$

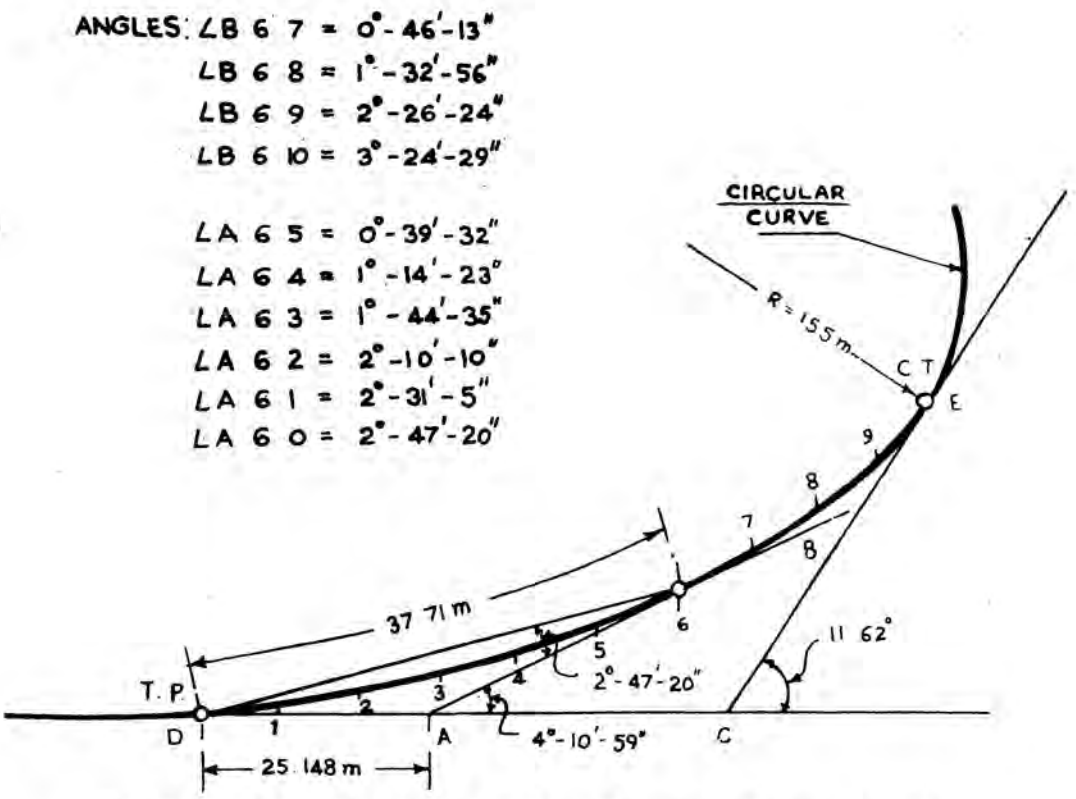


Fig. 37. Set out by polar deflection by shifting of instrument to intermediate station

The coefficients in column (9) gives the coefficient for the stations. The coefficients upto 5 are for back stations and 7,8,9, and 10 are forward set up. These are calculated as follows. Ordinarily, there is no need to calculate the values for points 1 to 5 except for check. However, these are shown in Table 11.9.

TABLE 11.9.

Station Points	0	1	2	3	4	5	6	7	8	9	10
Polar deflection angle coefficients	0.24	0.2167	0.1867	0.1500	0.1067	0.0567	0	0.0663	0.1333	0.2100	0.2933
Polar deflection angle θ_s × coefficients	2.788°	2.518°	2.169°	1.74°	1.239°	0.658°	0	0.770	1.548	2.44	3.408
Polar deflection angles in degrees	2° 47′ 2″	2° 31′ 5″	2° 10′ 10″	1° 44′ 35″	1° 14′ 23″	0° 39′ 32″	0	0° 46′ 13″	1° 32′ 56″	2° 26′ 24″	3° 24′ 29″

The points are ranged as usual with the polar deflections as noted above.

Set the instrument at 6 with reading equal to 2°—47′—20″ and sight to *TP*. Unclamp the top plate and set zero. The sight line is tangent to the spiral at point 6. Transit the instrument and sight to forward stations 7,8,9 and 10 with angles as noted in the above Table. The chord 6.7= 6.285 m.

Alternate to the above mentioned method of laying out the tangent the following may be adopted.

θ at point 6 = 11.62 × coefficient in Col. (1), Table 14 (page 41)
= 11.62 × 0.36 = 4.18320 = 4°—10′—59″

Coefficient for *L.T.* for θ = 41832 from Table 12 (Appendix 5) is 0.6669, L_s upto point 6 is 6.285 × 6 = 37.71 m.

$\therefore$ LT = 37.710 × 0.6669 = 25.148 m

Measure 25.148 m from *TP* along *TP—PI*. Sight the instrument from 6 to this point with zero reading. The sight line is the target at this point. Transit and range points 7,8,9 and 10 as described above.

Example 11.25. Calculations of a curve with unequal transition given the lengths of the unequal transitions

Design a curve for a hilly country on a National Highway—Δ=56°—Tangent distance along *AB* no limit, *BD*=180 m, Fig 38. For a curve of maximum radius the T_s has to be the longest possible, in this case, one half of *BD* that is 90 m. The length *BC* should not be greater than 90 m.

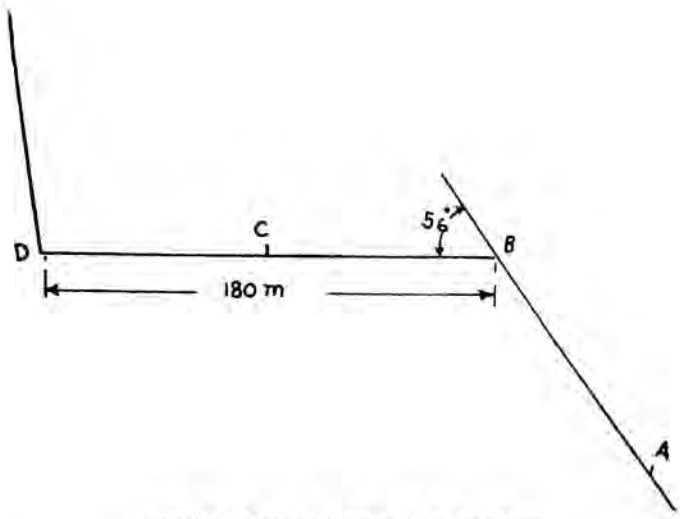


Fig. 38. Curve fitting in tight locations

Desirable minimum radius for N.H. in mountainous terrain for a speed of 50 km/hr. is 90 m. (Table 3) and L_s> 45 m (Choose 60 m) from Table 9.

Referring to Table 10 (Appendix 3) the T_s distance for a radius of 90 m and L_s = 60 m is 18.626 m and for a radius of 100 m, the tangent distance is 83.870 m. Selecting a radius of 100 m and design the curve for 60 m L_s along *BD* and L_s = 100 m along *BA*. The curve with a L_s = 60 m above the zig zag line and so will have a speed value of 50 km/hr. with the assumed rate of change of centrifugal acceleration. However if L_s = 40 m were adopted this would be below the zig zag line and have speeds less than 50 km/hr., but considering the limitations of the site, 40 m L_s may be adopted if unavoidable as it will give a rate of change of centrifugal acceleration slightly more than the assumed value.

From Table 10 (Appendix 3)
T_{s1} for R_{c1} = 100 m and L_{s1} = 60 m is 83.876 m
T_{s2} for R_{c2} = 100 m and L_{s2} = 80 m is 94.368 m

But these tangent distances are calculated on the assumption that the transitions are equal. So in this case they do not apply.

Refer to Fig. 39.

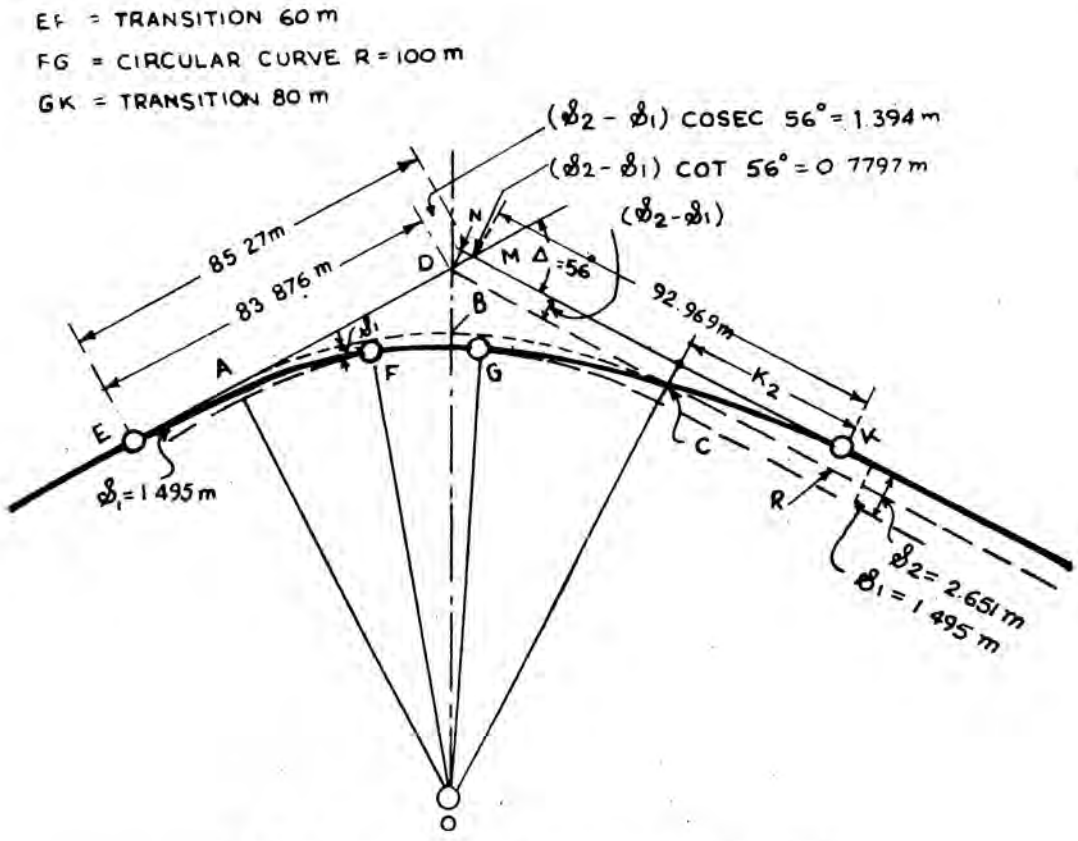


Fig. 39. Fitting transitions of unequal lengths in tight locations

FE = 60 m the shorter transition
GK = 80 m the longer transition
ABC (dotted line) is the circular curve with radius equal to 100 m
+ shift of the 60 m transition
DC is the tangent equal to curve ABC parallel to MK the main tangent
Draw a perpendicular DN to KM the tangent to the curve with unequal transitions
Let K_1 and K_2 be the K distances of the two transitions
Let s_1 and s_2 be the shifts of the 60 m and 80 m transition

$$DA = DC = (R_c + s_1) \tan \Delta/2$$

$$DM = (s_2 - s_1)/\sin \Delta$$

$\therefore$ ME the tangent distance of the 60 m transition

$$= DM + DA + AE$$

$$= (s_2 - s_1)/\sin 56° + DA + AE$$

$DA + AE = DE$ the tangent distance for a curve with 100 m R_c and 60 m L_s

$1 = 83.876$

$s_2 = 2.651\ k = 39.775$ from Table 11 (Appendix 4)

$s_1 = 1.495$ m Table 11 (Appendix 4)

$\therefore ME = (2.651-1.495)/\sin 56° + 83.876$ m

$= 85.270$ m

Tangent for the second spiral is $NK-NM$ and $NK = DR$

$\therefore$ Tangent for 2nd spiral $= DR-NM$

$DR = DC + CR = (R_c + s_1) \tan \Delta/2 + K$

$= (100 + 1.495)/\tan 28 + 39.778$

$= 93.7435$ m

$NM = (s_2-s_1) \cot 56°$

$= (2.651-1.495) \cot 56° = 0.7797$

Therefore, tangent for 2nd spiral $= 93.743-0.7797$

$= 92.9692$ m

Set out of the curve is similar to any other curve explained in para 7.9.

Example 11.26. Calculations for introducing a transition when the centre of the existing curve is retained

Introduce a spiral in an existing curve of radius 200 m (Fig. 40) in an O.D.R. in plain country, retaining the centre of the curve.

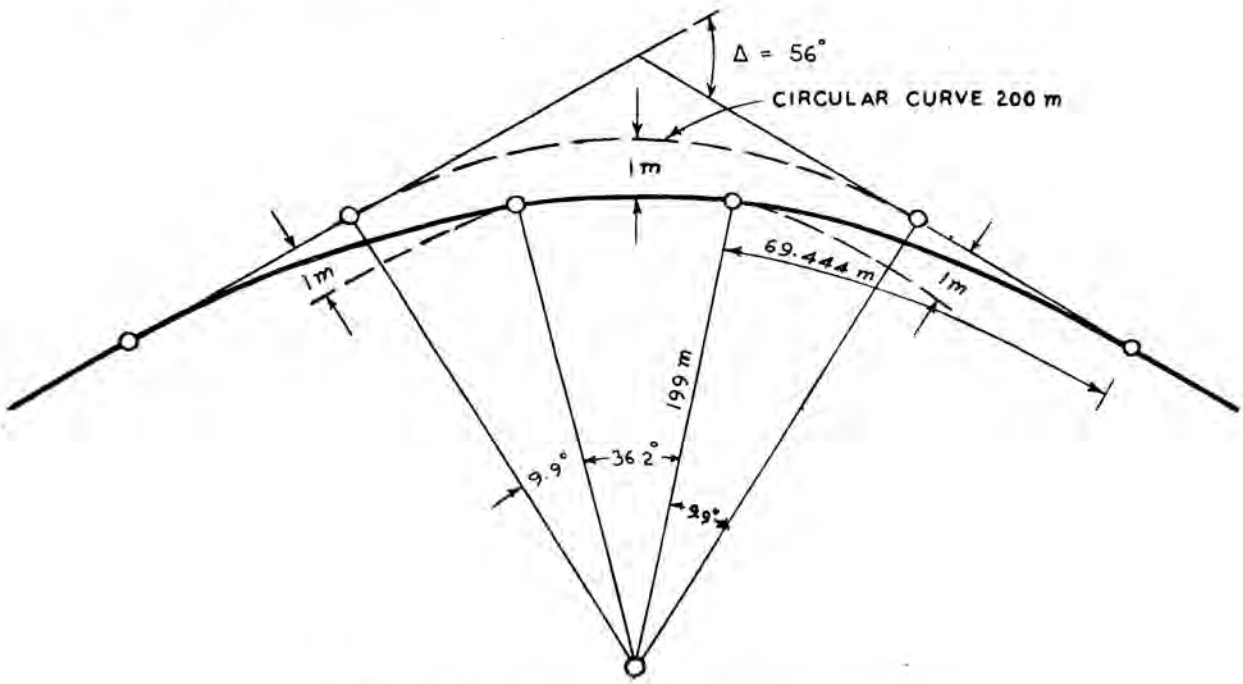


Fig. 40. Introducing transitions without shifting centre of curve

Design speed of O.D.R. is 65 km/hr (Table 2).

Referring to Table 9 (page 31), the minimum transition length for an R_c of 200 m is 60 m.

From Table 11 (Appendix 4), shift = 0.749

Since the centre of the curve is to be retained, the radius of the curve that will now result will be 200−0.749 = 199.251

When L = 60 m and R_c = 199.251

$$\theta_s = \frac{60 \times 28.65}{199.251} = 8.627°$$

Shift for unit length from Table 12 (Appendix 5) is 0.01255

∴ Shift for a length of 60 m is 0.01255 × 60 = 0.753 m

Actual radius of the curve would be 200−0.753 = 199.247

This is slightly less than the assumed radius of 199.247 m. So recalculation is necessary assuming the shift of 199.251 m.

To avoid the trial and error the procedure outlined below may be followed. Since the center of the curve is to be retained, reduction in the radius of the curve is inevitable. So assume a radius of 199 m. This is fixed by inspection from Table 15 (page 44). Since the existing radius is 200 m and the minimum L_s for this radius is 60 m, the shift for this combination is 0.749 m. So assume a shift of 1 m. Therefore the radius is 200−1 = 199 m. To find the L_s required for

s = 1 m and R_c = 199 m

$$\frac{s}{R_c} = \frac{1}{199} = 0.00502$$

Referring to Table 12 (Appendix 5) column $\frac{S_x}{R}$

$\theta_s = 9.9°$

s for unit length of L_s when $\theta_s = 9.9°$ is 0.0144

$$\therefore L_s \text{ required} = \frac{1}{0.0144} = 69.444 \text{ m}$$

The other curve functions are calculated as described in para 7.9. and the curve set out as explained in para 7.9, Fig. 40.

Example 11.27. Calculations for introducing a transition in an existing curve without altering its radius

(A) Introduce a spiral in a circular curve of 200 m radius. As mentioned in para 7.10.3, if the L_s of the transition is 100 m, the shift necessary is 2.079 m, Table 11 (Appendix 4).

Since this is a curve for which values are figured in the table the curve is set out without any calculations.

(B) In case the existing curve has a radius equal to one of the values not figured in Table 11 (Appendix 4), the following procedure should be adopted.

Given the radius of the existing curve on O.D.R. is 165 m introduce transitions without reducing the radius.

Refer to Table 9 (page 31). The minimum L_s for a radius of 165 m is 75 m adopting an L_s = 90 m

$$\theta_s = \frac{90 \times 28.65}{165} = 15.627°$$

Shift for unit L_s and $\theta_s = 15.627°$ is 0.02265 (Table 12, Appendix 5)

So shift for $L_s = 90$ is $0.02265 \times 90 = 2.039$ m

The other curve functions are calculated as described in para 7.7. and the set out as in para 7.9, Fig. 41.

$X_c = 89.330$ m

$Y_s = 8.154$ m

$K = 44.892$ m

$S.T. = 30.213$ m

$L.T. = 60.237$ m

$L.C. = 89.703$ m

$T_s = (R + s)\ tan\ \Delta/2 + K$

$= 133.708$ m

$E_s = (R_c + s)\ sec\ \Delta/2 - R_c$

$= 24.183$ m

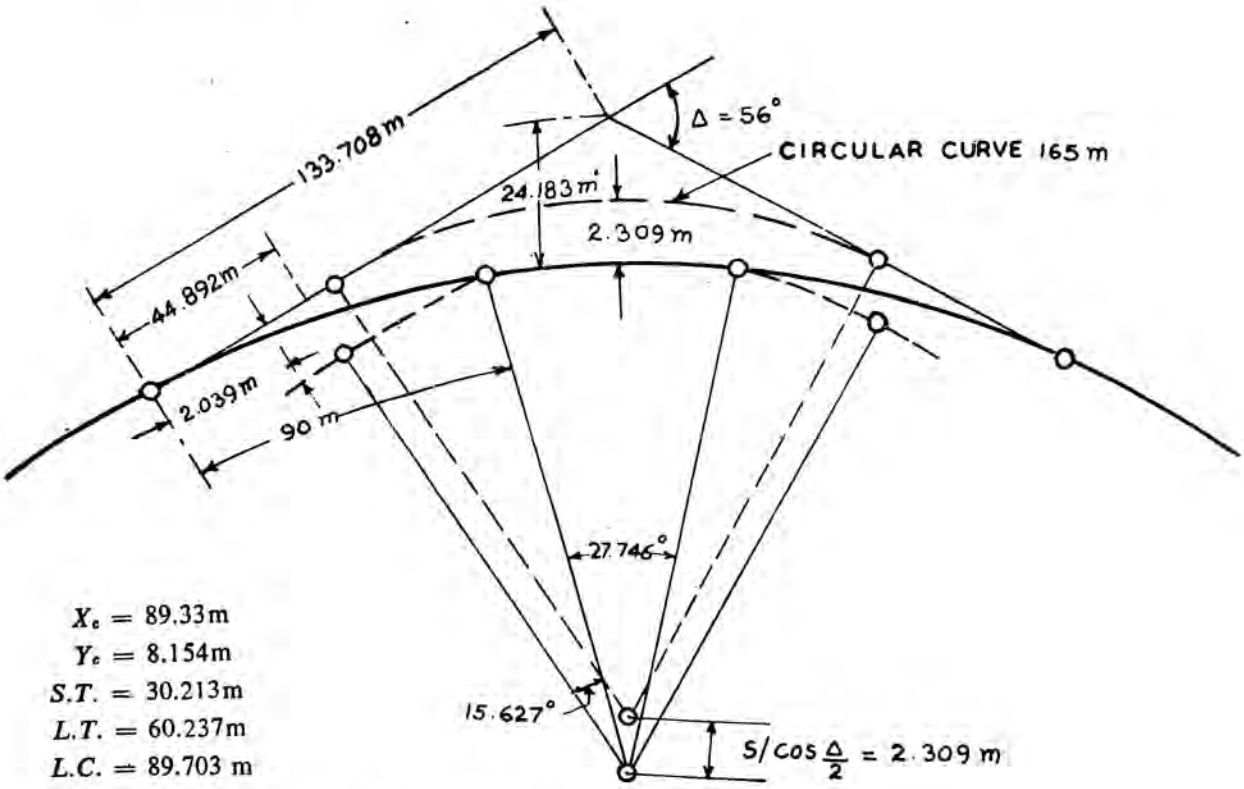


Fig. 41. Introducing transition without attaining radius

Example 11.28. Calculations for introducing a transition curve when a curve of sharper radius is added

Refer para 7.10.3 (4). Introduce a transition into a curve of radius = 400 m on a National Highway, $\Delta = 56°$. Introduce sharper curve say 350 m on the side. Assume the central angle for 400 m curve to be 50°.

Referring to Table 9 (page 31) the minimum transition for $R_c = 350$ m and speed 100 km/hr. is 130 m.

θ_s for $R_c = 350$ m and $L_s = 130$ m $= 10.64°$ (10° 38′ 29″)

Shift from Table 12 (Appendix 5) $= 130 \times 0.01548 = 2.0124$ m

Therefore it is not possible to have the central angle consumed by the 400 m radius curve as 50°.

Referring to Fig. 42, $PB = PR + QG + GH$

$\therefore R = R_c + s + (R - R_c) \, Cos \, \Delta_2$

$400 = 350 + 2.0124 + 50 \times Cos \, \Delta_2$

$\therefore Cos \, \Delta_2 = \frac{47.9875}{50} = 0.959752$

$\therefore \Delta_2 = 16.31° = 16° 18° 39''$

$\therefore$ Angle consumed by the central 400 m radius $= 56° - 2 \times 16.31° = 23.38°$

Angle consumed by the 350 m radius curve is $16.31° - 10.64° = 5.67°$

From Table 9 (page 31) it is seen that the minimum transition length for a radius less than 400 m and more than 350 m is 122 m. So if a value of 375 m is assumed for the sharper radius $L_s = 122$ m, Fig. 42.

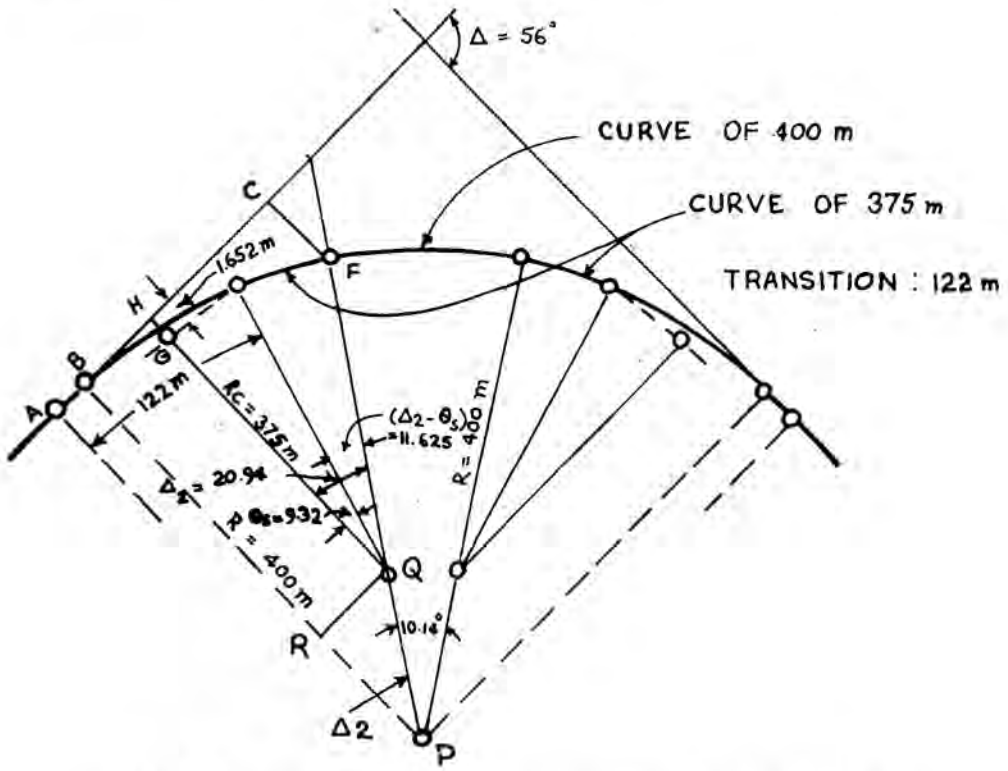


Fig. 42. Introducing sharper circular curve and transitions to retain existing circular to the maximum

$$\theta_s = \frac{122 \times 28.65}{375} = 9.32°$$

s for $L_s = 1$ and $\theta = 9.32°$ is 0.01354

s for $L_s = 122$ m and $\theta_s = 9.32°$ is 1.652 m

$\therefore 400 = (375 + 1.652) + 3.93 + 25\ Cos\ \triangle_2$

$$\therefore Cos\ \triangle_2 = \frac{23.395}{25} = 0.93392;\ \triangle_2 = 20.945°$$

So angle consumed by the 375 m radius curve is 20.945 − 9.32 = 11.625°.

Since it is desirable that the radius of the circular curve that will be introduced should differ from the existing curve as little as possible, adopt the radius of 375 m.

It can be seen that the radius of the new circular curve can be increased further until it is equal to the radius of the existing circle minus the shift required to introduce the transition. Thus in the limit the problem is the same as the one described in paras 7.10.3. (1) and Example 11.26.

The other values of the transition are calculated as explained in para 7.7.

From Table 12 (Appendix 5)

$X = 0.99738$	$X_c = 121.68$ m
$Y = 0.05412$	$Y_c = 6.603$ m
$L.C. = 0.6676$	$L.T. = 81.447$ m
$S.T. = 0.3342$	$S.T. = 40.773$ m
$L.C. = 0.9988$	$L.C. = 121.854$ m
$K = 0.4996$	$K = 60.951$ m

Example 11.29 : Calculation for widening proportionate to distance from the start of the curve : Calculate the widening and the cross-sections for the curve mentioned below. Nature of surface is thin bituminous surfacing, Width of pavement on straight = 7 m.

$R_c = 175$ m, $L_s = 30$ m Design speed 40 km p.h. Refer to Table 7 (page 23). Widening required is 0.6. m. By proportion widening required at distances from the T.P. are given in Table 11.10.

TABLE 11.10.

	Extra widening	Width	Distance of edges of pavement from centre line		
			When widening is equal on both sides	When widening is on inside	
				Outer	Inner
1	2	3	4	5	6
T.P.	0	7.0 m	3.5 m	3.5 m	3.5 m
Distance from					
T.P. 5 m	0.1 m	7.1 m	3.55 m	3.5 m	3.6 m
10 m	0.2 m	7.2 m	3.60 m	3.5 m	3.7 m
15 m	0.3 m	7.3 m	3.65 m	3.5 m	3.8 m
20 m	0.4 m	7.4 m	3.70 m	3.5 m	3.9 m
25 m	0.5 m	7.5 m	3.75 m	3.5 m	4.0 m
30 m or C.T.	0.6 m	7.6 m	3.80 m	3.5 m	4.1 m

The 7.6 m width is continued throughout the circular curve.

The distances are measured normal to the centre line.

Case (i) when the widening is desired equally on both sides of the centre line, the distances figured in column (4) are used, Fig. 43.

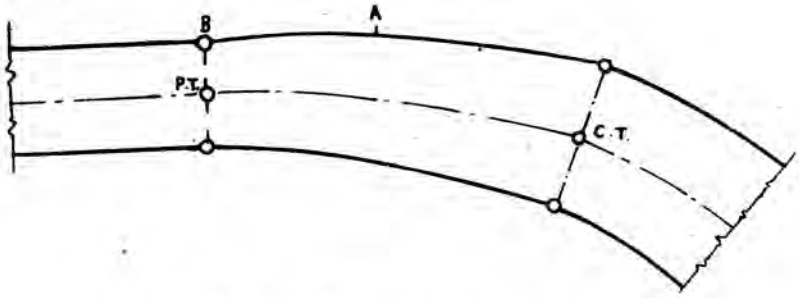


Fig. 43. Widening over transition

Case (ii) when widening is desired on the inside, the distances figured in columns (5) and (6) are used, Fig. 44

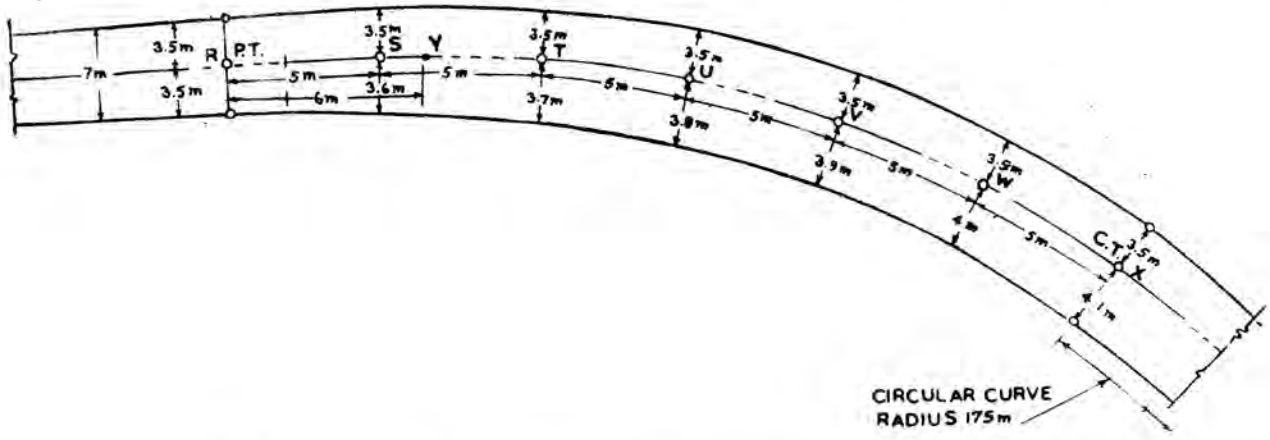


Fig. 44. Widening on the inside proportional to distance from the start of the curve

Building in superelevation when the widening is entirely on the inside

Refer to Table 4 (page 17). Superelevation for a curve of 175 m for a speed of 40 km/h is 0.042. Camber of surface is 2 per cent consisting of two straights. For a 3.5 m lane, camber $= 3.5 \times 0.02 = 0.07$ m. The outer edge of the pavement should be raised gradually starting at 6 m from the T.P. so that it is level with the crown at the T.P., Fig. 45.

Raise the outer half at the same rate as was done before T.P. until it is in line with the inner half of the road. Thus the distance of the point where the outer half and inner half will be in one and the same plane will be 6 m along the curve from the T.P., Fig. 45.

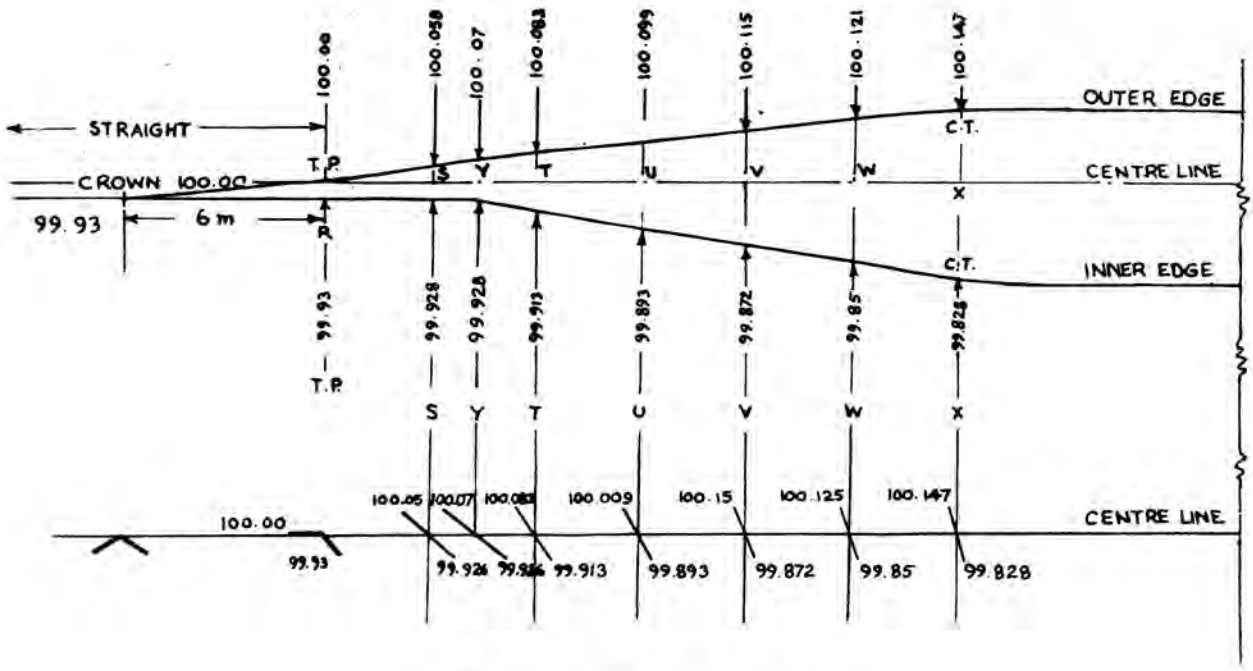


Fig. 45. Superelevation run off and widening

Rotate the surface of the road about the centre line thus raising the outer half and lowering the inner half until the required superelevation is attained at C.T., i.e., the start of the circular curve. This distance in which the full superelevation will be built to 30 — 6 = 24 m. Assuming the central line to be level and the level of the crown to be 100, the level of the outer and inner edges 6 m before the start of the curve are 100 — 0.07 = 99.93 m. Level of the outer edge at 6 m from T.P. on the curve is 100 + 0.07 = 100.07 m.

The levels of the outer and inner edges of the pavement at C.T. are :

Outer edge $100.00 + 0.042 \times 3.5 = 100.147$

Inner edge $100.00 - 0.042 \times 4.1 = 99.828$

The values for intermediate points *S T U V W* are given in Table 11.11. The slope at intermediate points are calculated as follows :

Slope at Y = camber = 0.02

Slope at X = Super-elevation $\Big\}$ = 0.042

Change in slope for 24 m length = 0.022

∴ Slope at say T 10 m from T.P. or 4 m

from $Y = 0.02 + \dfrac{0.022 \times 4}{24} = 0.0237$ and so on

TABLE 11.11.

Point	Distance from TP (metre)	Distance from centre (metre)	Outer edge			Inner slope			
			Slope at the point	Height above central line (metre)	Level at the outer edge (metre)	Distance from centre (metre)	Slope	Height below central line (metre)	Level of the inner edge (metre)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
R	TP	3.5	0	0	100.00	3.5	Camber 0.02	0.07	99.930
S	5	3.5	0.0166	0.058	100.058	3.6	0.02	0.072	99.928
Y	6	3.5	0.02	0.07	100.07	3.62	0.02	0.0724	99.928
T	10	3.5	0.0237	0.083	100.083	3.7	0.0237	0.0876	99.913
U	15	3.5	0.0282	0.0988	100.099	3.8	0.0282	0.1735	99.893
V	20	3.5	0.0328	0.1149	100.115	3.9	0.0328	0.128	99.872
W	25	3.5	0.0374	0.131	100.131	4.0	0.0374	0.1496	99.850
X	30 or C.T.	3.5	0.042	0.147	100.147	4.1	0.042	0.1722	99.828

Fig. 45 shows the cross-sections at the various points, as also a longitudinal profile showing the levels of the outer and inner edges. It is seen that there are changes in the grades of the outer and inner edges at Y and X. These are rounded off by short vertical curves as shown.

It can be seen that the outer edge changes its slope at a greater rate between Y and T.P. than between Y and C.T. If so desired, the change in outer half of the road from camber to superelevation could be accomplished in a greater length say 10 m.

When the widening is equally distributed on the inside and outside of the centre line the distances in columns 3 and 7 of Table 11.11. will be equal. Otherwise, the procedure is the same as when the widening is on the inside only.

Example 11.30 Calculations for edges of pavement when the radius of the circular curve and transition lengths are the same as that of the central line

Design the edges of the pavement when the radius of the curve is 155 m. $L_s = 80$ m for the central line $\Delta = 56°$. Design speed 50 km/h.

The edges to have the same L_s and R_c as the centre line. Width on the straight portion is 7 m, Fig. 46.

Produce the tangent $A_o B_o$ and $E_o D_o$ of the outer edge line to meet at C_o. Similarly produce the inner edges of the pavement on the straights to meet at C_i.

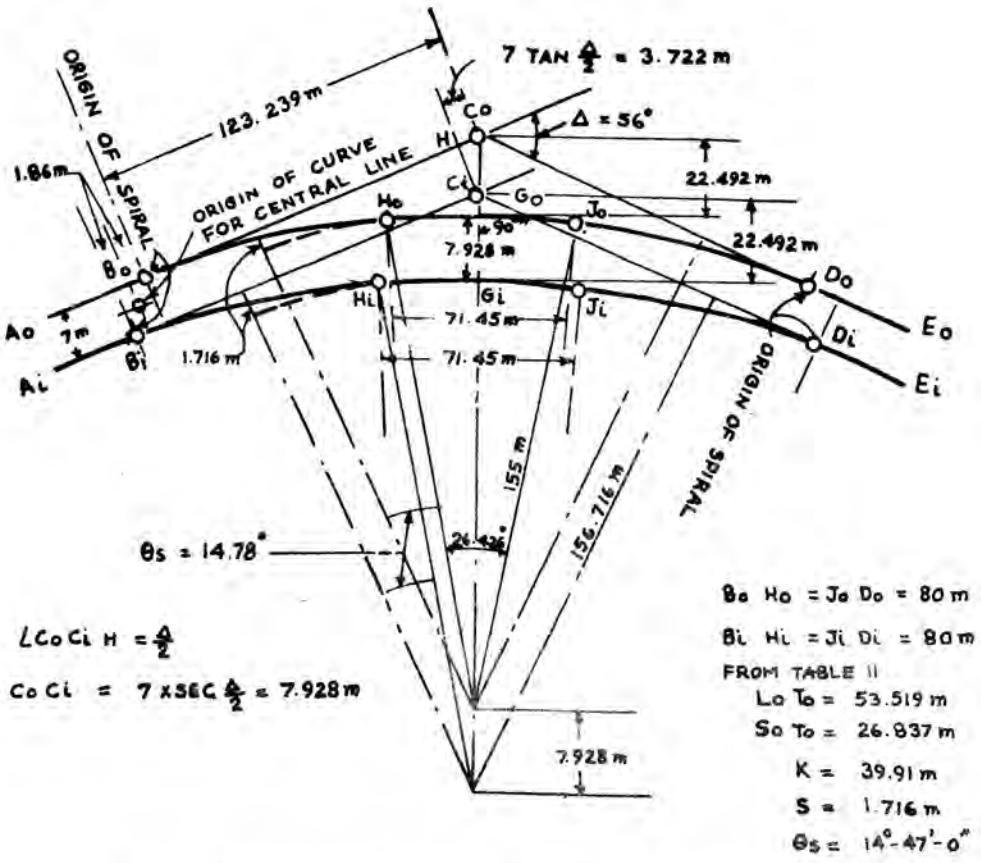


Fig. 46. Transition curve for outer and inner edge of widened pavement

Since the edges of the pavement and the centre line have the same radii, transition lengths and deviation angle, their tangent and apex distances are also same.

From Table 10 (Appendix 3)

T_s = 123.239 m

E_s = 22.492 m

Referring to Fig. 46.

$G_i C_o = C_i C_o + C_i G_i = G_o C_o + G_i G_o$

$= C_i C_o + E_s = E_s$ + width at centre of curve

$\therefore$ Width on straight $\times$ sec. $\frac{\Delta}{2}$ = width at centre of the curve

= sec. 28° = width at centre of curve

= 7 × 1.1326 = 7.9282 m

From Table 7 (page 23) the widening required is 0.6 m.

Since the widening secured is very nearly 0.6 m, the layout may be adopted.

The tangent points, i.e. the start of the curves for the edges of the pavement, will not be opposite that of the central line. The tangent points of the inner and outer edges of the pavements will be $\left(\frac{1}{2} \text{ width on the straights} \times \tan \frac{\Delta}{2} \right)$ on either side of that of the central line

$$\text{(i.e.)} \frac{7 \times \tan 28^\circ}{2} = 3.5 \times 5317 = 1.86 \text{ m}$$

$$\theta_s = \frac{28.65 \times L_s}{R} = \frac{28.65 \times 80}{155} = 14.787^\circ$$

The other curve functions and set out are calculated as described in paras 7.7. and 7.9. The transition is a standard one and values can therefore be read from Table 11 (Appendix 4) or calculated from use of Table 12 (Appendix 5) as before.

Example 11.31. Calculations for the edges of the pavement when the amount of widening is specified and curves employed are not concentric

Design transitions for the edges of a pavement with a widening of 1.2 m.

$R_c = 155$ m; $L_s = 80$ m for central line. $\Delta = 56^\circ$

Inner Edge

Pavement width is 7 m

Assume a radius of 155 m and $L_s = 80$ m for the inside curve.

Therefore the E_s from the point of intersection of inner tangent (from Table 10, (Appendix 3) is 22.492 m, $T_s = 123.239$ m.

Refer to Fig. 47.

The point of intersection of the outer tangents would be at a distance equal to EH from H the mid-point of the inside edge.

$$EH = FH + EF$$
$$= 22.492 + 7 \sec 28^\circ$$
$$= 22.492 + 7.928 = 30.42 \text{ m}$$

Required widening equals $GH = 7 + 1.2 = 8.20$ m

E_s for the outer curve $EG = EH - GH$
$= 30.42 - 8.20$
$= 22.22$ m

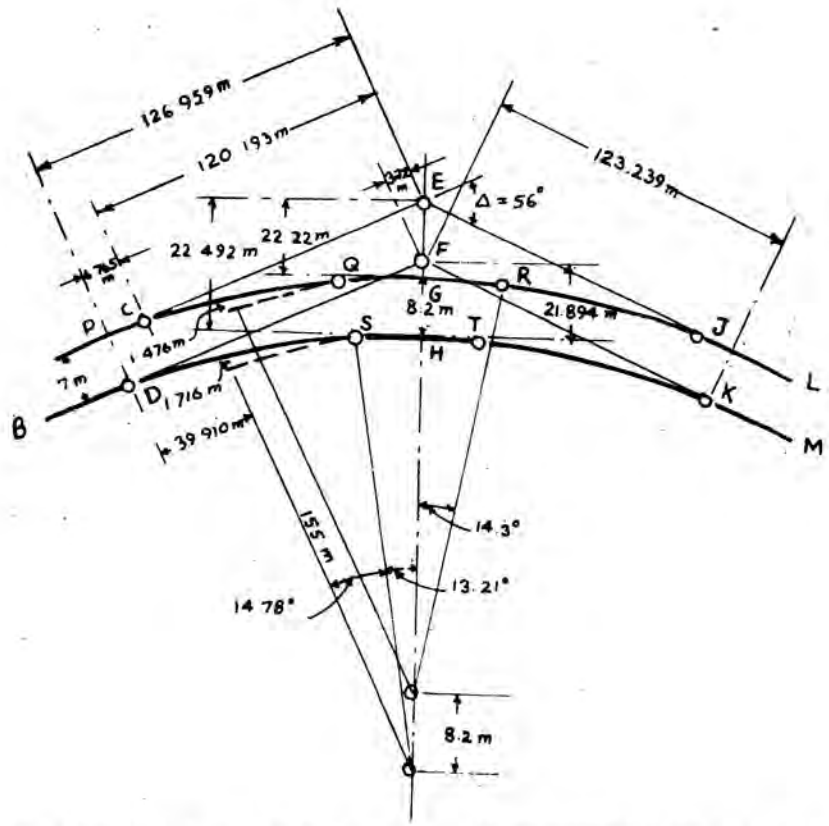
Outer Edge

Assume a radius of 155 m for the outer curve also.

The E_s required for this curve is 22.22 m, $R_c = 155$ m

So the L_s required can be worked as in Example 11.5.

$$E_s = \frac{R_c + s}{\cos \frac{\Delta}{2}} - R_c$$



OUTER TRANSITION L_s = 74.124 m

θs = 13.7°
K = 36.995 m
δ = 1.476 m
L.T. = 49.567 m
S.T. = 24.846 m
XG = 73.701 m
YC = 5.885 m
R_C = 155 m

INNER TRANSITION L_s = 80 m = DS

θs = 14.787°
K = 39.910 m
δ = 1.716 m
L.T. = 53.519 m
S.T. = 26.837 m
XC = 79.469 m
YC = 6.849 m
R_C = 155 m

Fig. 47. Transitions for widened edges of pavement non-concentric layout

$$\therefore\ 22.22 = 155 \sec 28° - 155 + s \sec 28°$$

$$\Rightarrow 20.548 + 1.1326\ s$$

$$\therefore\ \text{Shift} = \frac{22.22 - 20.548}{1.13257} = 1.476 \text{ m}$$

$$\frac{s}{R_c} = \frac{1.476}{155} = 0.0095$$

Refer to column $\frac{Sx}{R}$ in Table 12 (Appendix 5). The θ_s which will satisfy this condition is 13.7°

The radius for a unit L_s when θ_s is 13.7° is 2.0911

$\therefore$ The length that will give a radius of 155 m is $\frac{155}{2.0911} = 74.124$ m

K for a unit L_s for θ_s of 13.7° is 0.4991 (Form Table 12, Appendix 5)

$\therefore$ K for L_s of 74.124 m is $74.124 \times 0.4991 = 36.995$ m

The tangent distance T_s for the outer curve

$T_s = (155 + 1.476) \tan 28° + K = 120.193$ m

Refer to Fig. 48.

$EC = T_s = 120.193$ m

$NE = NF \tan 28°$

$= 7 \tan 28° = 0.5317 \times 7 = 3.72$ m

$DF = 123.239$ m (T_s inner curve)

$PE = DF + NE = 123.239 + 3.72 = 126.959$

$PC = PE - EC$

$= 126.959 - 120.1932 = 6.765$ m

Instead of choosing 155 m for the outer radius any higher or lower value could be chosen and the length of L_s worked out. It is preferable to choose a larger radius say 170 m. If a radius much larger than 155 m say 200 m is chosen even a short transition will not suit as the E_s distance will exceed the value of 22.22 m that is required. Inspection of Table 10 (Appendix 3) will help choosing the largest radius possible. A fully transition curve can also be employed, as worked out below.

Refer to Table 13 (page 38) against column $\Delta = 56°$

E_s for 100 m of L_s $= 18.137$ m

$\therefore$ L_s for $E_s = 22.22$, is $\frac{22.22 \times 100}{18.137}$ $= 122.511$ m

The radius of this will be $\frac{122.511 \times 28.65}{28} = 125.356$ m

T_s for the fully transitional curve $= \frac{106.153 \times 122.511}{100} = 130.049$ m

$\therefore$ The start of this curve is $130.049 - 3.72 - 123.239 = 3.09$ m from P, towards A, see Fig. 48.

Example 11.32. Calculations for concentric layout for edges of the pavement

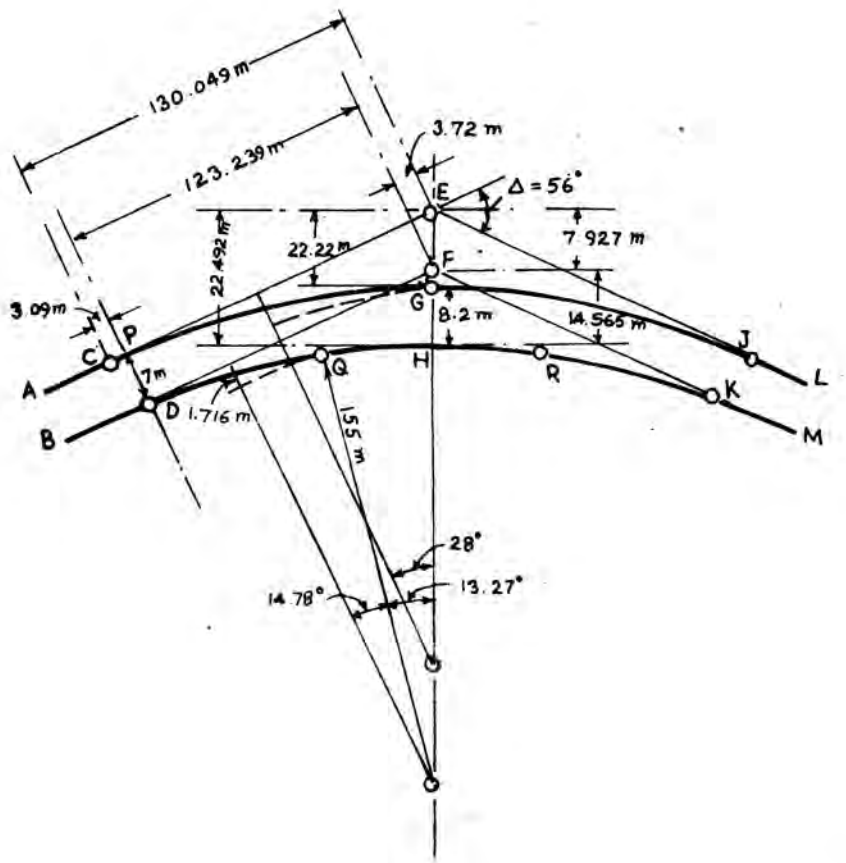
Centre line

$R_c = 155$ m, $L_s = 80$ m for the central line, $\theta_s = 14.787°$

$\Delta = 56°$ — width of surface 7 m — widening required say 1.2 m on the inside

From Table 10 (Appendix 3)

$E_s = 22.492$ m and $T_s = 123.239$ m for the centre line



OUTER TRANSITION = CG = 122.511 m

θ_s	= 28°
XC	= 119.619 m
YC	= 19.614 m
$L.T.$	= 82.719 m
$S.T.$	= 41.788 m
K	= 60.777 m
s	= 4.949 m
Radius (From Table-12)	= 125.356 m

INNER TRANSITION = DQ = 80 m

θ_s	= 14.787°
XC	= 79.469 m
YC	= 6.849 m
$L.T.$	= 53.519 m
$S.T.$	= 26.837 m
K	= 39.910 m
s	= 1.716 m

Fig. 48. Transition for outer and inner curves

From Table 11 (Appendix 4)

$\theta_s = 14° - 47' - 9''$

$LT_c = 53.519$ m

$s_c = 1.716$ m

$K_e = 39.910$ m

$ST_e = 26.837$ m

$L_e = 79.762$ m

Inner Edge (Refer to Fig. 49)

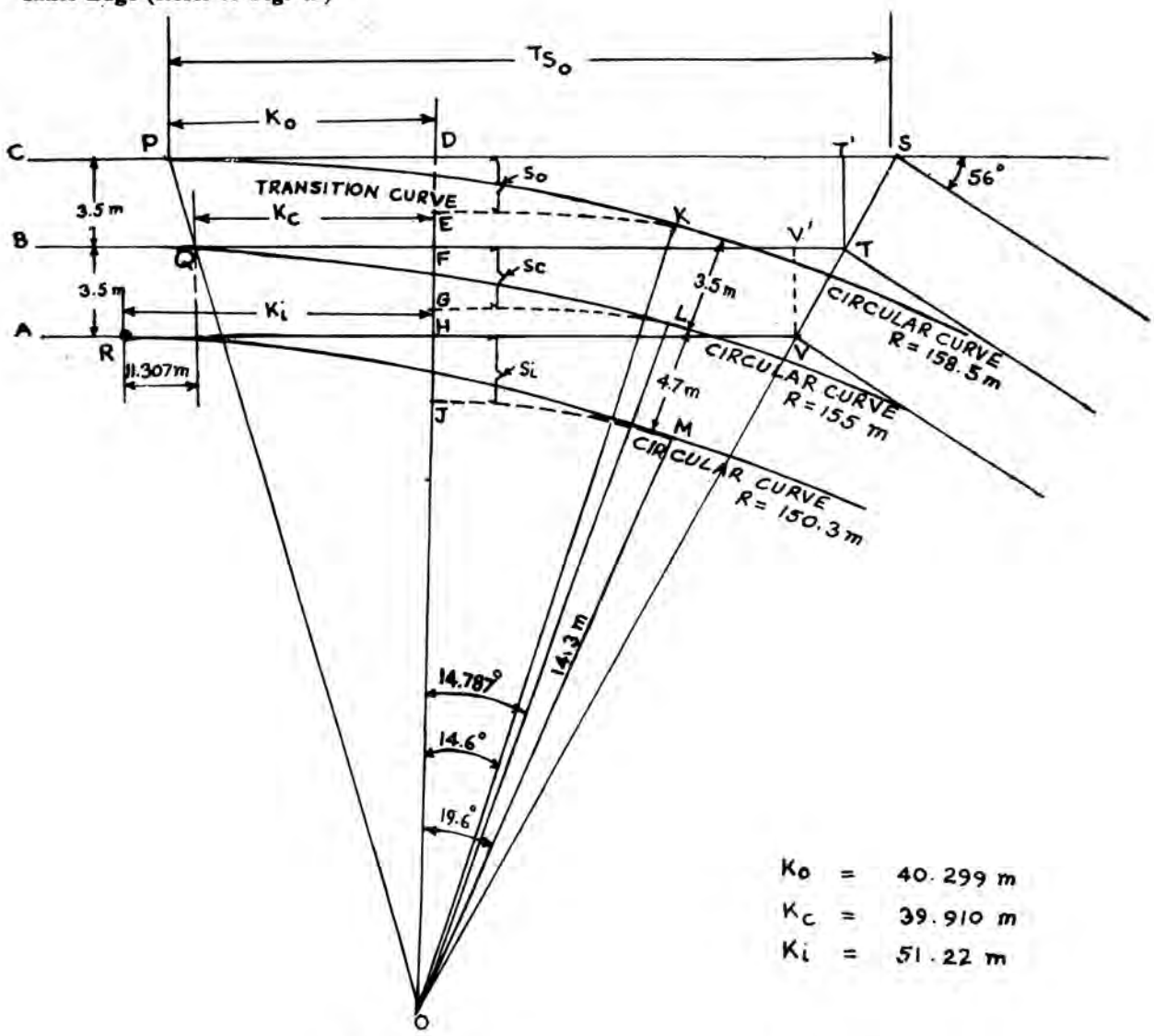


Fig. 49. Transitions for concentric layout of edges

Radius of the inner edge = 155 − 3.5 − 1.2 = 150.3 m

$OF = OG + GF = R_c + s_c$

$= OJ + JH + HF = R_i + s_i + 3.5$

Equating (1) and (2) and transpassing

$s_i = R_o + s_o - R_i - 3.5$

But $R_i = R_o - 3.5$ − Extra widening

or $R_c = R_i + 3.5$ + Extra widening

$\therefore s_i = R_i + 3.5$ + Extra widening $+ s_c - R_i - 3.5$

$= s_c$ + Extra widening

∴ Shift of the inner curve is the sum of extra widening required and the shift of the centre line = 1.716 + 1.2 = 2.916 m

Find out the L_s required for a radius of 150.3 m and shift of 2.916 m, as in Example 11.12.

$$\therefore \quad \frac{s_i}{R} = \frac{2.916}{150.3} = 0.01940$$

Referring to Table 12 (Appendix 5) column $\frac{s_x}{R}$

$\theta_s = 19.6°$

R for L_s unit and $\theta_s = 19.6°$ is 1.4616

$$\therefore \quad LS_i = \frac{150.3}{1.4616} = 102.8325 \text{ m}$$

Referring to Table 12 (Appendix 5) K per unit L_s and θ_s of 19.6° is 0.4981

$\therefore K_i = 102.83 \times 0.4981 = 51.22$ m

$$\therefore \quad TS_i = (R_c + s_i) \tan \frac{\Delta}{2} + K_i$$

$= (150.3 + 2.916) \tan 28° + K_i$

$= 153.216 \times .5317 + 51.22 = 132.685$ m

Refer to Fig. 49.

$U'T = 3.5 \tan 28° = 1.861$ m

$QT = 123.239$ m $= T_{s_c}$ for central line

$\therefore QU' = 123.239 - 1.861 = 121.378$ m

$UR = T_{s_c} = 132.685$ m

∴ The inner curve will start 132.685 − 121.378 = 11.307 m ahead of the curve of the centre line.

Δ_c for centre line $= 56° - 2 \times 14.787 = 26.426°$

Δ_c for inner edge $= 56° - 2 \times 19.6° = 16.8°$

Outer Edge

Since widening is entirely on the inside Radius 155 + 3.5

= 158.5 m

Since there is no widening on outside, the shift of the outer curve is equal to that of the centre line i.e., 1.716 m

Length is worked out as before

$$\frac{\text{Shift}}{\text{Radius}} = \frac{1.716}{158.5} = 0.0108$$

Refer to Table 12 (Appendix 5) $\theta_s = 14.6°$

R for $\theta_s = 14.6°$ and L_s unity is 1.9622 and

$\therefore L_{s_o}$ for R of 158.5 is $\frac{158.5}{1.9622} = 80.776$ m

and K for unit L_s and θ_s of 14.6° is 0.4989

$\therefore K_o$ is equal to $80.776 \times 0.4989 = 40.299$ m

$T_{so} = (R_o + s_o) \tan \frac{\Delta}{2} + K_o$

$= (158.5 + 1.716)\ .5317 + 40.299 = 125.486$ m

$PS = T_{so} = 125.486$ m

Referring to Fig. 49, ST' 3.5 = tan 28° = 1.861 m

$QT = 123.239$

PT' $PS - ST = 125.486 - 1.861 = 123.625$

∴ The start of the outer transition is 123.625 − 123.239

i.e., 0.386 m away from a point on the outer tangent opposite the start of the curve on the centre line.

Δ_o for the outer curve = 56 − 2 × 14.6 = 26.8°

The lengths of the circular arcs, and values of other functions are calculated as usual. These are given in Table 11.12.

Example 11.33. Details of the Transition for Compound Curves

Computations of spiral tangents for a compound curve transition

Given : R_1 = 600 m; R_2 = 240 m; L_s 55 m (Fig. 50)

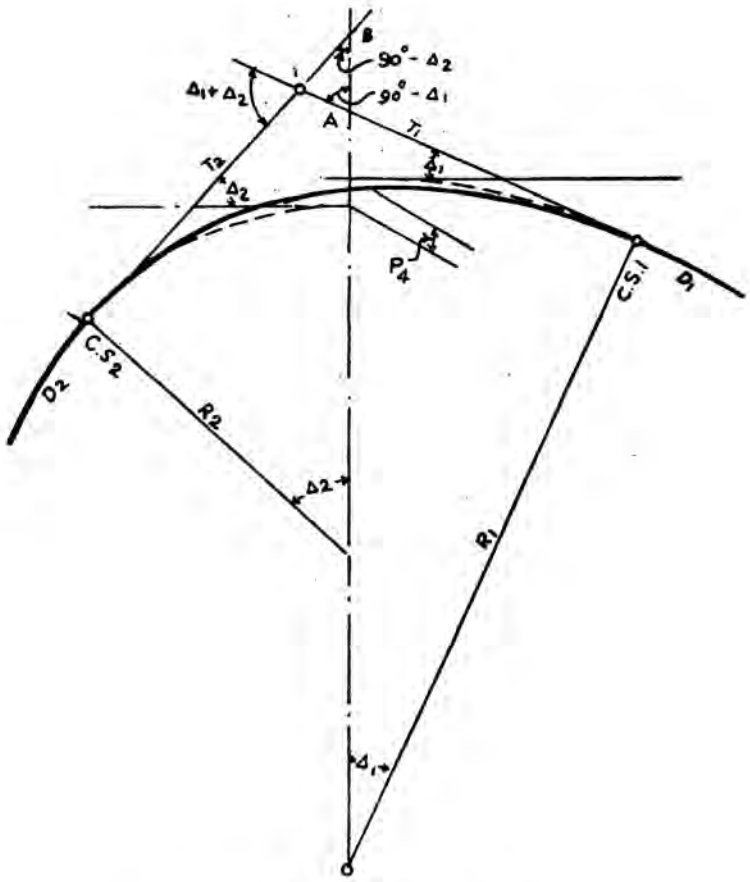


Fig. 50. Transition for compound curve

$$\theta_a = 28.65 \times 55\left(\frac{1}{240} - \frac{1}{600}\right) = 3.939°$$

P_a = (Table 12 Appendix 5) = $0.00574 \times 55 = 0.03156$ m

$$\Delta_1 = \frac{28.65 \times 55}{600} = 2.626° = 2°37'35''$$

$$\Delta_2 = \frac{28.65 \times 55}{240} = 6.565° = 6°33'56''$$

$AB = 240 \times \text{exsec } 6.565° - 600 \text{ exsec } 2.626° - 0.03156$

$= 1.5841 - 0.6307 - 0.03156$

$= 0.9218$ m

$$AI = 0.9218 \times \frac{\text{Cos } 6.565}{\text{Sin } 9.191} = 5.733 \text{ m}$$

$$BI = 0.9218 \times \frac{\text{Cos } 2.626}{\text{Sin } 9.191} = 5.7651 \text{ m}$$

$T_1 = 600 \times \text{Tan } 2.626 + 5.733 = +33.252$ m

$T_2 = 240 \times \text{Tan } 6.565 - 5.7651 = -21.855$ m

Example 11.34. Computations for location of spiral by offsets from compound curve

For the example in para 11.33, calculate the offsets at 10 m intervals.

The offset at a distance of x from the start of the curve is

$$\frac{P_a}{2} \times \frac{x^3}{\left(\frac{L_a}{2}\right)^3}$$

$$\text{Offset at 10 m from start of curve} = \frac{0.03156}{2} \times \frac{10^3}{\left(\frac{55}{2}\right)^3} = 0.0007587$$

TABLE 11.12.

	Circular curve			Transition								Whole curve		
	Radius	Central angle	Length	Length	Deviation angle	Shift	X_c	Y_a	LT	ST	L.C.	K	T_s	E_s
Outer edge	158.5	26.8	74.10	80.78 m	14.6	1.716	80.25	6.83	54.04	27.09	80.54	40.299	125.486 m	23.96 m
Central edge	155 m	26.426	71.45	80 m	14.787	1.716	79.469	6.849	53.519	26.837	79.762	39.910	123.239	22.492
Inner edge	150.3	16.8	44.05	102.83	19.6	2.916	101.64	11.63	68.98	34.66	102.29	51.22	132.68	23.23

TABLE 11.13.

Distance x from CS_2 or CS_1	10	20	60
Offset from curve	0.00076 m	0.006 m	0.164 m

Offsets are measured inward from 600 m radius curve. Offsets are measured outward from 240 m radius curve.

Example 11.35. Calculate deflection angles for the 5-chord spiral for conditions given in Example 11.33.

$\theta_a = 3.939°$

Chord length $= \frac{55}{5} = 11$ m

$\frac{1}{3} \times \frac{\theta_a}{L_a^2} = \frac{1}{3} \times \frac{3.939}{55 \times 55} = 0.000434$

Set up on S.C. 1.

TABLE 11.14.

Point	L from S.C.1	L^2	ϕ for spiral $= \frac{L^2}{La^2} \times \frac{\theta a}{3} = L^2 \times 0.000434$	ϕ for $R_c = 600$ m $= \text{Sin}^{-1}\left(\frac{C}{2R}\right)$	Deflection angle ϕ
S.C. 1					
1	11	121	0.052514	0.5252186	0.577736
2	22	489	0.0210056	1.05048	1.071487
3	33	1089	0.472626	1.57583	2.0484586
4	44	1936	0.840224	2.1013162	2.9415402
5	55	3025	1.31285	2.62697	3.9398268

Example 11.36. Calculate deflection angles for the 10-chord spiral for the conditions given in Example 11.33. entire curve visible from S.C.I.

$\theta_a = 3.939°$

Chord $= \frac{55}{10} = 5.5$ m

ϕ for spiral computed by multiplying co-efficients in first column of Table 14 (p. 41) by 3.939

Set-up on S.C.1

TABLE 11.15.

Point	L from S.C.1	ϕ for spiral	ϕ for R 600 m $= \text{Sin}^{-1}\left(\frac{C}{2R}\right)$	Deflection angle ϕ
S.C. 1				
1	5.5	0.0033 × 3.939 = 0.01299	0.2626065	0.2755963
2	11.0	0.0133 × 3.939 = 0.052388	0 5252186	0.5776066
3	16.5	0.0300 × 3.939 = 0.11817	0.78784	0.906048
4	22.0	0.0533 × 3.939 = 0.20995	1.05048	1.2604314
5	27.5	0 0833 × 3.939 = 0.328118	1.3131432	1.6412612
6	33	0.1200 × 3.939 = 0.47268	1.5758326	2.0485126
7	38.5	0.1633 × 3.939 = 0.643287	1.83855	2.4818421
8	44	0 2133 × 3.939 = 0.840188	2.1013162	2.9415042
9	49.5	0.2700 × 3.939 = 1.06353	2.3641216	3.4276516
S.C. 2	55	0.3333 × 3.939 = 1.31287	2.6269768	3.9398468

Example 11.37.

Same conditions as in Example 11.36. except that beyond point 6 curve cannot be seen from S.C.1.

R at point 6 $= 600 - \frac{3.3}{55}(600 - 240) = 384$ m

Set-up on point 6

TABLE 11.16.

Point	Points from point 6	L from point 6	ϕ for spiral	ϕ for $R = 384$ m $= \text{Sin}^{-1}\left(\frac{C}{2R}\right)$	Deflection angle ϕ
S.C.$_1$	6	33	$0.1200 \times 3.939 = 0.47268$	1.57583	2.0485126
6	0	0	0	0	0
7	1	5.5	$0.0033 \times 3.939 = 0.01299$	0.4103248	0.4233148
8	2	11	$0.0133 \times 3.939 = 0.052388$	0.8206707	0.8730587
9	3	16.5	$0.0300 \times 3.939 = 0.11817$	1.2310587	1.3492287
S.C.$_2$	4	22.0	$0.0533 \times 3.939 = 0.20995$	1.6415059	1.8514599

Example 11.38. Design suitable transitions for the curves shown in Fig. 51 for design speed of 50 km/h in plain country

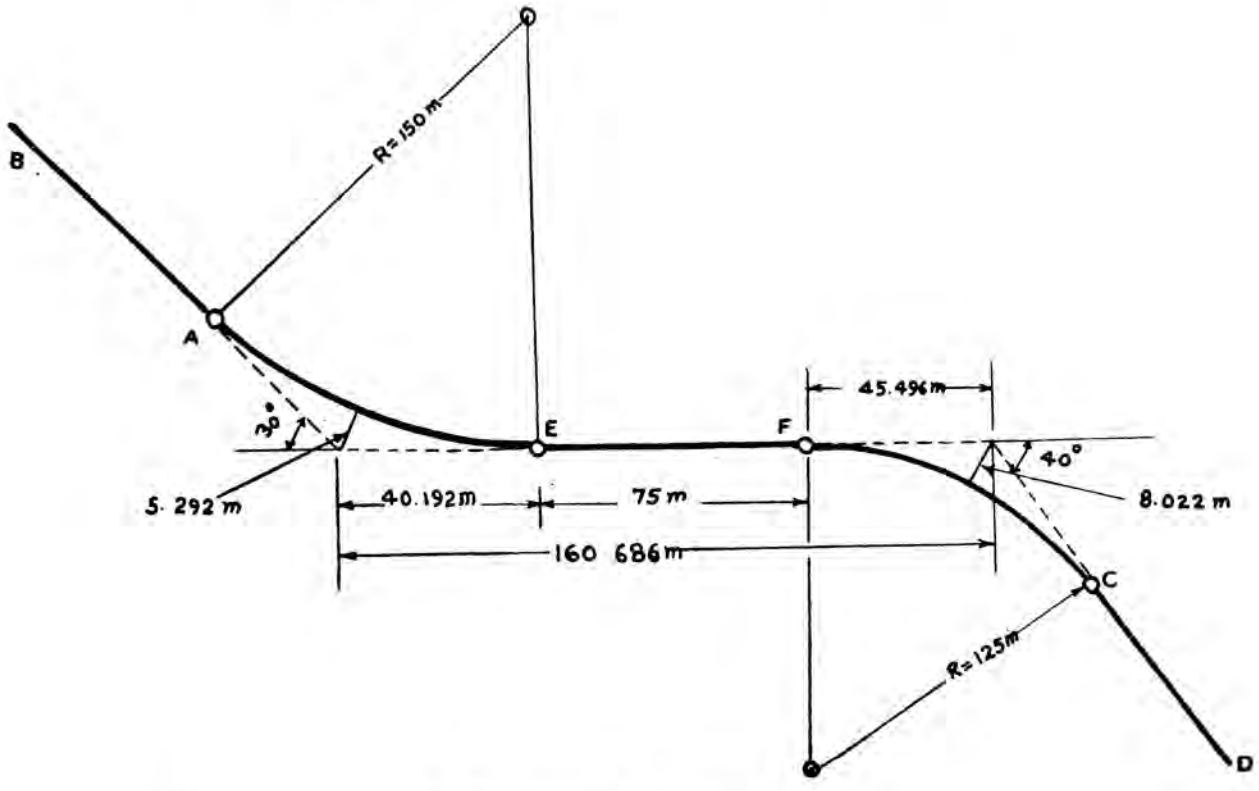


Fig. 51. Existing circular reverse curve

In this example two simple curves AE and FC of radii 150 m and 125 m respectively are separated by tangent EF of length 75 m. In such a case each curve may be treated as a separate problem and adjusted to permit insertion of a transition between it and the fixed tangent.

The lengths of transitions required for curve radii of 150 m and 125 m for design speed of 50 km/h are 45 m and 55 m respectively (Table 9, page 31).

The shifts and K distances are as given in Table 11 but are not available for Figures here. So use Table 12 and complete as below :

Curve AE

$\Delta = 30°$
$R_c = 150$ m
$L_s = 45$ m
$\theta_s = 8.595°$
$s_s = 45 \times 0.012495$
$= 0.5623$ m
$K = 45 \times 0.4996$
$= 22.482$ m
$T_s = (150 + 0.5623)$ Tan 15
$+ 22.482$
$= 62.825$ m
$E_s = \frac{(150 + 0.5623)}{\text{Cos } 15} - 150$
$= 5.8736$ m

Curve FC

$\Delta = 40°$
$R_c = 125$ m
$L_s = 55$ m
$\theta_s = 12.606°$
$s_s = 55 \times 0.018306$
$= 1.0068$ m
$K = 55 \times 0.4992$
$= 27.456$ m
$T_s = (125 + 1.0068)$ Tan 20
$+ 27.456$
$= 73.318$
$E_s = \frac{(125 + 1.0068)}{\text{Cos } 20} - 125$
$= 9.874$ m

The original tangent between the reverse curves is reduced from 75 to 75—22.482—27.456 = 25.062 m. The complete layout will be as in Fig. 52.

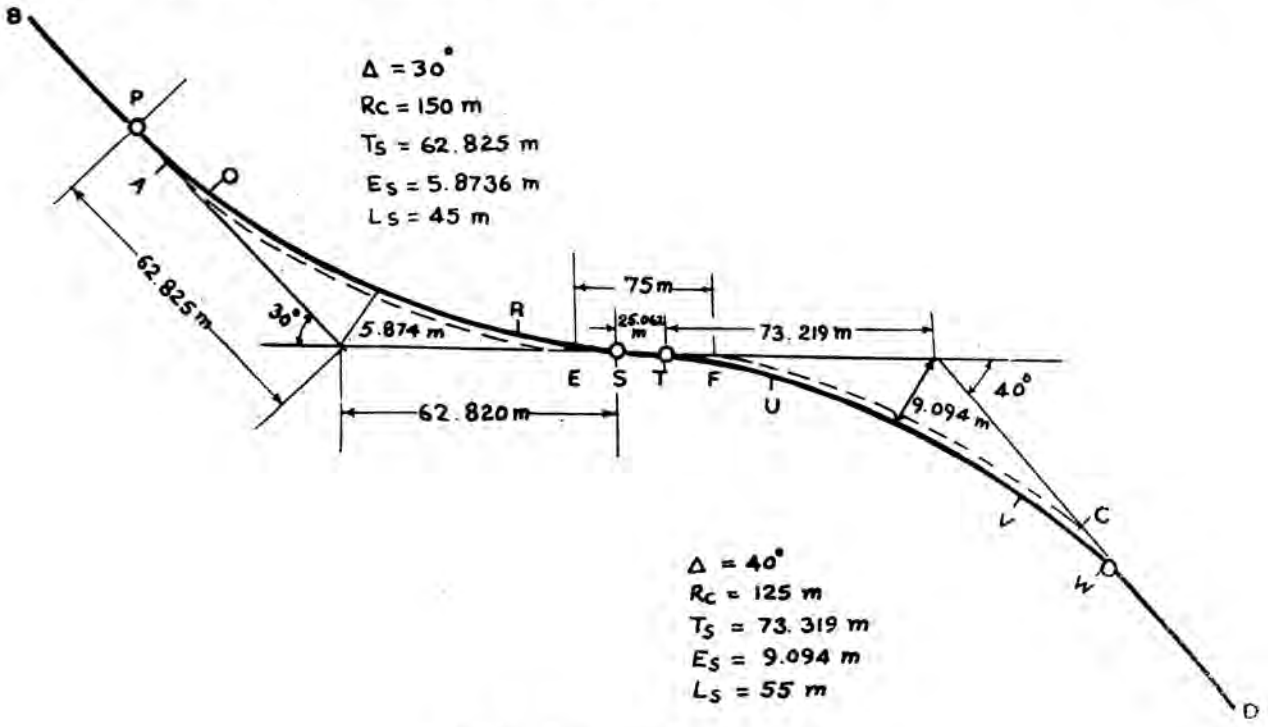


Fig. 52. Transitions in reverse curve

Example 11.39. For the conditions given in Example 11.38. design the Reverse Curves if the curves AE and FC cannot be moved

$$\Delta_1 = \text{Tan}^{-1}\frac{T}{R_1 + R_2} = \text{Tan}^{-1}\frac{75}{150 + 125}$$

$$= \text{Tan}^{-1}\, 0.27227 = 15.255°$$

$$= 15° - 15'-18''$$

In Fig. 53

$$O_1\, O_2 = \frac{R_1 + R_2}{\text{Cos}\Delta_1} = \frac{275}{\text{Cos } 15.255} = 285.0436 \text{ m}$$

$$\Delta_2 = \text{Cos}^{-1} = \frac{R_1 + s_1 + R_2 + s_2}{O_1\, O_2}$$

$$= \text{Cos}^{-1}\frac{150 + 0.5623 + 125 + 1.0068}{285.0436}$$

$$= \text{Cos}^{-1}\, 0.9667612$$

$$= 14.813936° = 14°\, 48'\, 50''$$

$\Delta = \Delta_1 - \Delta_2 = 15°\, 15'\, 18'' - 14°\, 48'\, 50'' = 0° - 26' - 18''$

$0° - 26' - 18''$ is the angle to be added to the 125 m and 150 m radii curves.

Straight distance along the new tangent $O_2T = 285.043 \text{ Tan } \Delta_2 = 75.386$ m

K distance of transition curve of 45 m length and radius 150 m = 22.482 m

K distance of transition curve of 55 m length and radius 125 m = 27.456 m

Straight distance between S.T. and T.S. 75.386 − 22.482 − 27.456 = 25.448 m

The complete layout will be as in Fig. 53.

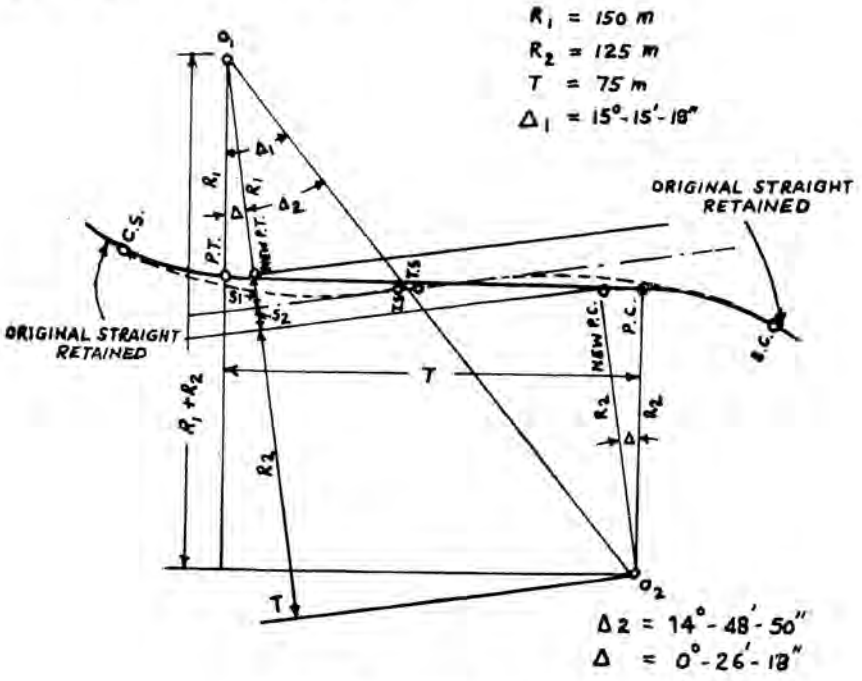


Fig. 53. Transitions in reverse curve

Example 11.40. Transitions for Hair Pin Bends

Design hair pin bend curve in mountainous and steep terrain with the following data :

Design speed = 25 km/h

Intersection angle ... 165°

Minimum radius of curve (Table 3 page 12) ... 20 m

Width of roadway at hair pin bend (para 10.2.) ... 7.5 m

Width of roadway at straight (IRC: 52, Table 2) ... 4.75 m

Minimum length of transition (Table 9 page 31) ... 35 m

Inner Curve

$\Delta = 165°$

Assuming the inner curve to be fully transitional $\theta_i = \frac{\Delta}{2} = \frac{165°}{2} = 82° - 30'$

$R_i = 20$ m

From Table 12 (Appendix 5) for $\theta = 82.50$

$R = 0.3473\ L_s$

$\therefore L_s$ (length of curve $= \frac{20}{0.3473} = 57.5871$ m (OK > Min.)

The other properties of the transition curves are obtained from Table 12 (Appendix 5) and are tabulated below :

TABLE 11.17.

s_i	x_i	y_i	k_i
0.1115 × 57.5871 = 6 42096 m	0.81165 × 57.5871 = 46.74057 m	0.4134 × 57.5871 = 23.8065 m	0.46735 × 57.5871 = 26.9133 m

Middle Curve

$\Delta = 165°$

$R_c = 20 + \frac{7.5}{2} = 23.75$ m

$s_c = R_i + s_i + \frac{4.75}{2} - R_c = 20 + 6.421 + 2.375 - 23.75$

$= 5.046$ m

$\frac{s_c}{R_c} = \frac{5.046}{23.75} = 0.2125$

From Table 12 (Appendix 5) for $\frac{s_c}{R_c} = 0.2125$, θ_c is $66.2521° + 66° - 15' - 8''$

L_{sc} Length of curve $\frac{23.75}{0.43244} = 54.921$ m

For $\theta_c = 66.2521°$ the other properties of the curve are given in Table 11.18.

TABLE 11.18.

s_c	x_c	y_c	k_c
0.09163 × 54.921 = 5.032 m	0.8743 × 54.921 = 48.017 m	0.34804 × 54.921 = 19.114 m	0.47856 × 54.921 = 26.282 m

Outer Curve

$\Delta = 165°$

$R_o = 20 + 7.5 = 27.5$ m

$s_o = R_i + s_i + 4.75 - R_o = 20 + 6.42096 + 4.75 - 27.5 = 3.671$ m

$$\frac{s_o}{R_o} = \frac{3.671}{27.5} = 0.1334894$$

For $\frac{s_o}{R_o} = 0.1335°$ is 52.04°

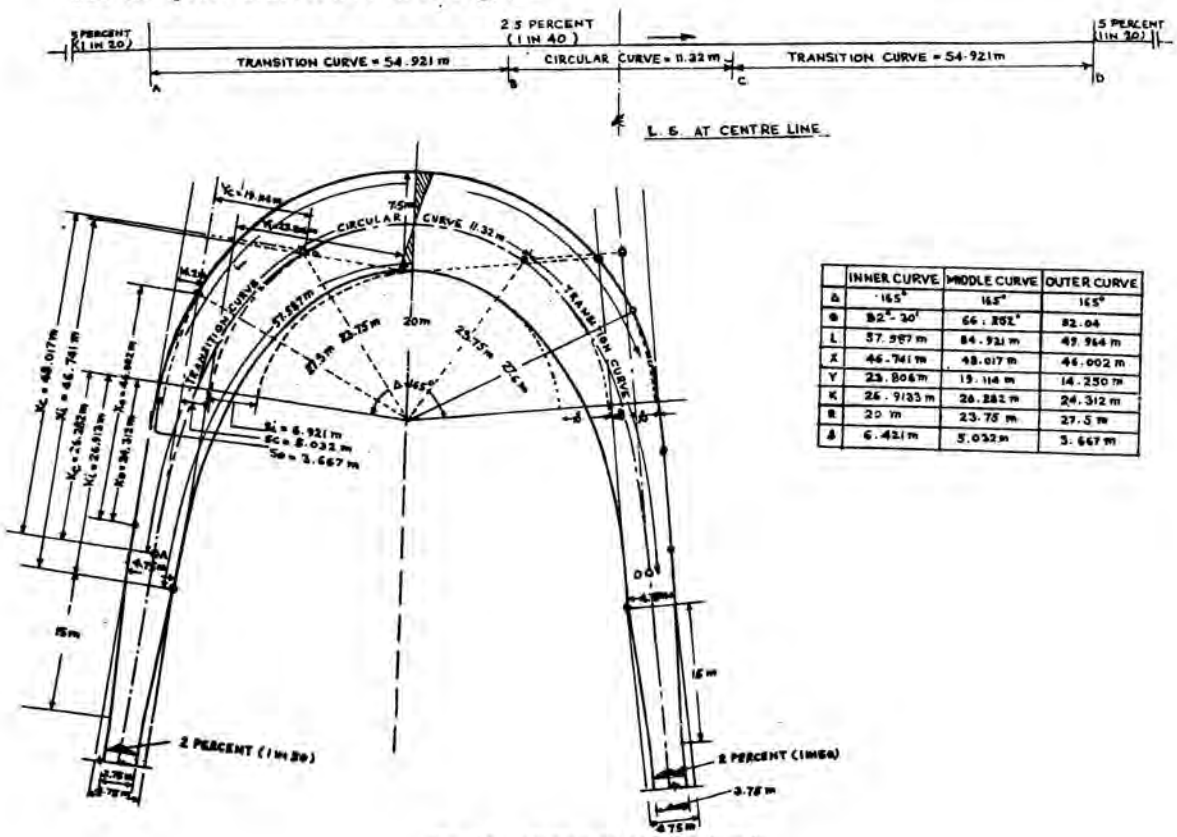
Length of curve $\frac{27.5}{0.5504} = 49.964$ m

The other properties of the curve are given in Table 11.19.

TABLE 11.19.

s_o	x_o	y_o	k_o
0.0734 × 49.964 = 3.667 m	0.9287 × 49.964 = 46.002 m	0.2852 × 49.964 = 14.250 m	0.486 × 49.964 = 24.312 m

The complete draft is shown in Fig. 54.



	INNER CURVE	MIDDLE CURVE	OUTER CURVE
Δ	165°	165°	165°
θ	82°-30'	66°-52'	82.04
L	57.987 m	54.921 m	49.964 m
X	46.741 m	48.017 m	46.002 m
Y	23.806 m	19.114 m	14.250 m
K	26.9133 m	26.282 m	24.312 m
R	20 m	23.75 m	27.5 m
s	6.421 m	5.032 m	3.667 m

Fig. 54. Design of hair pin bends

Appendix 1

THE SPIRAL AND ITS OSCULATING CIRCLE

1. DEFINITION

An osculating circle at any point in a plane curve is that circle having a common tangent with the curve at that point with its radius equal to the radius of curvature of the curve at that point. In the case of a spiral, the rate of divergence of the osculating circle from the spiral from their common point is the same as that of the spiral from the tangent at T.P. If the tangent at the starting point of the spiral is termed the initial tangent, and the common tangent to the spiral and osculating circle at any point in the spiral is termed the local tangent at the point, the included angle at the common point between two equal chords in the spiral and osculating circle is the same as the polar deflection angle to an equal chord of the spiral. This means that the deflection angle between the local tangent and the chord of the spiral is the algebraic sum of the deflection angle of the osculating circle for an equal chord length, and the polar deflection for an equal chord length, of the spiral. This geometric property enables easy shift of the angular instrument, where necessary, in the set out of the curve in the field.

Referring to Fig. 55.

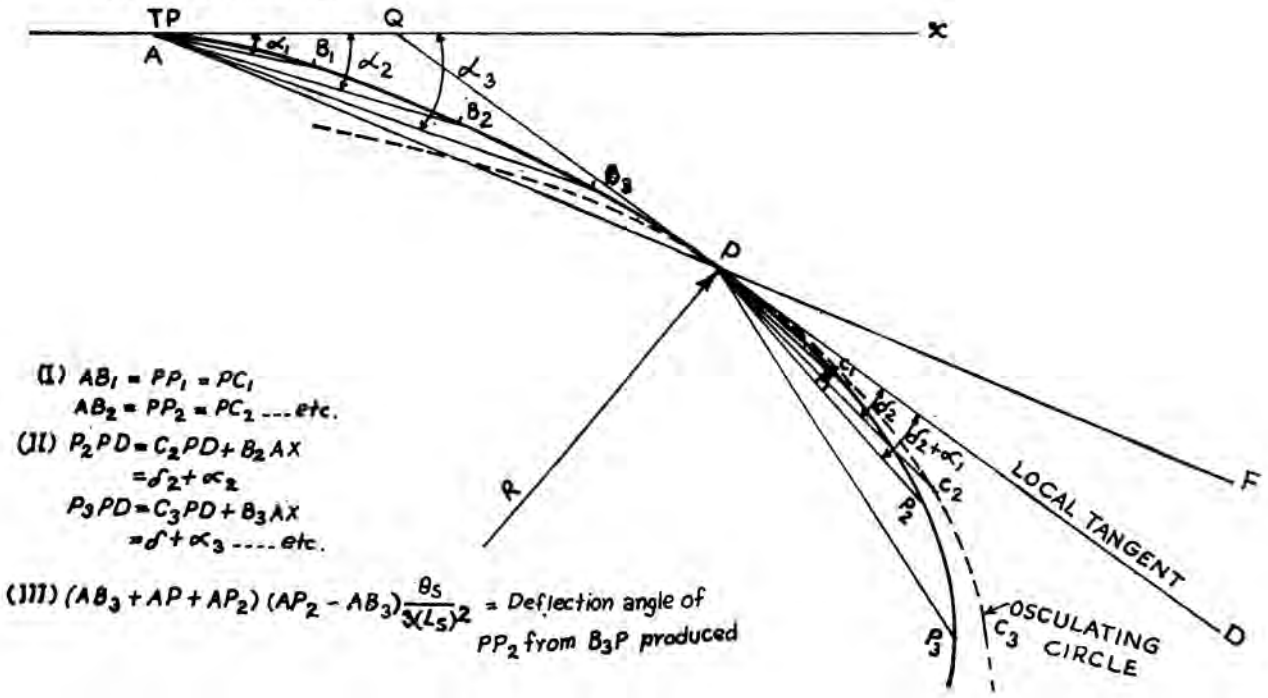


Fig. 55

Let P be the point upto which the spiral has been ranged out, and it is required to find out deflections from the local tangent PD to chords $P.P_1$, $P.P_2$, $P.P_3$, etc.

From the T.P. or A mark off AB_1, AB_2, AB_3 each equal to $P.P_1$, $P.P_2$, $P.P_3$ respectively.

Draw the osculating circle $PC_1\ C_2\ C_3$ and mark off points $C_1\ C_2\ C_3$ such that $P.C_1 = P.P_1$; $PC_2 = PP_2$; $PC_3 = PP_3$; etc.

We then have $PP_1 = PC_1 = AB_1$;

$PP_2 = PC_2 = AB_2$; and so on.

2. To find deflection angle $P_2\,PD$ for the chord PP_2 Procedure

Let deflection angle to C_2 from PD (C_2PD) be δ_2

and deflection angle to B_2 from AX (B_2AX) be α_2

Then by the theorem given above $P_2PD = \delta_2 \pm \alpha_2$
(plus sign for P_2 forward of P, and minus sign for P_2 backward of P).

Now $PC_2 = PP_2$; and

$$\delta_2 = \frac{PC_2}{2R} \times 57.3 \text{ degrees by the property of the circle.}$$

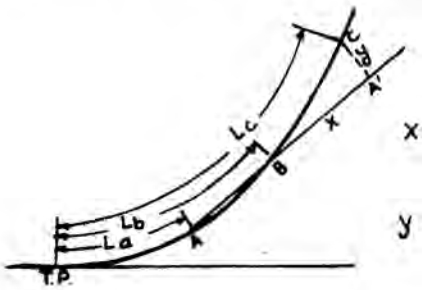
Also $R = \frac{L_s}{L} \times R_c$ where L (AP), L_s, and R_c are known.

and $\alpha_2 \left(\frac{PP_2}{L_s}\right)^2 \times \frac{\theta_s}{3}$

Since all the curve points are set out for a 10 chord spiral each length PP_1, PP_2 etc. will be 0.1, 0.2 etc. of L_s and calculations are easily made even mentally.

From the above relationship between the spiral and its osculating circle Orville Kafoid has evolved another formula enabling the forward setting out of points from any point.

If A, B, and C, are any three consecutive points in a Spiral distant L_a, L_b and L_c respectively from the starting point $T.P.$ (Fig. 56) the external angle A^1BC subtended by the chords AB, and BC is given by the equation.



$$X = BC.\cos.A'BC = BC.\cos.\left[es\,\frac{(La+Lb+Lc)(Lc-La)}{3L_s^2}\right]$$

$$y = BC\ \sin.A'BC = BC\ \sin\left[es\,\frac{(La+Lb+Lc)(Lc-La)}{3L_s^2}\right]$$

Fig. 56.

$$\text{Ext. angle } A^1BC = \theta_s\,\frac{(L_a \times L_b + L_c)(L_c - L_a)}{3L_s 2}$$

Where L_s = the full transition length from $T.P.$ to $C.T.$
and θ_s = the total tangent deflection of the curve.

Appendix 2

1. PROPERTIES OF A CIRCULAR CURVE

1.1. The external deflection angle Δ between tangents is equal to the central angle and

$$\Delta = \frac{180}{\pi} \cdot \frac{L}{R}$$

Where L = is the arc length in metres between two tangents

R = radius in metres of circular curve

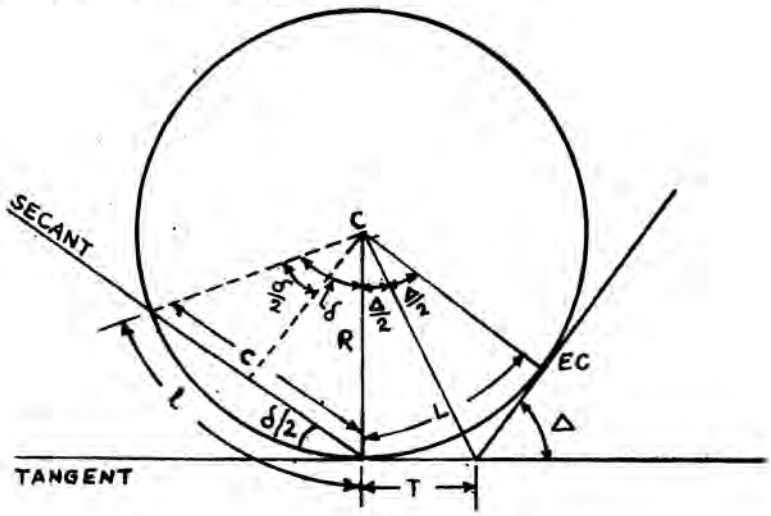


Fig. 57.

1.2. The deflection angle between a secant and a tangent of the circular curve or between two secants intersections on the arc is equal to one half of the central angle subtended by the intercepted arc : i.e.,

$$\frac{\delta}{2} = \frac{180}{\pi} \cdot \frac{l}{2R} = \frac{90.l}{\pi R}$$

Where l = is any arc length

δ = is the central angle subtended by the arc

1.3. The chord length, C being the straight distance between any two points on the arc is

$$C = 2\,R.\ \mathrm{Sin}\frac{\delta}{2} = 2\,R\ \mathrm{Sin}\left(\frac{90\ l}{\pi\ R}\right)$$

$$\text{or } \frac{\delta}{2} = \mathrm{Sin}^{-1}\left(\frac{C}{2R}\right)$$

Where C = is the chord length in metres

δ = is the central angle (degrees) subtended by the chord C or by arc of length l.

1.4. Tangent distance and Apex distance is given by

$$T_e = R \tan\left(\frac{\Delta}{2}\right)$$

$$E_e = R.\left[\sec\left(\frac{\Delta}{2}\right)^{-1}\right]$$

$$L_c = \frac{\pi}{180} \cdot \Delta \cdot R .$$

Table 16 gives Tangent Apex distances and length of curves of 100 m radius. Actual curve components of any radius can be determined by multiplying the table values by (actual radius/100)

Table 17 gives for a range of Radius, the deflection angles for arcs of 1 m, 10 m, 20 m and 50 m and chord lengths for arcs of 10 m, 20 m and 50 m, deflection angles for chords of 10, 20 and 50 m.

TABLE 16. TANGENT, APEX DISTANCE AND LENGTH OF CURVES CIRCULAR THROUGHOUT OF 100 m RADIUS

Deflection Angle $\Delta°$	Tangent Distance (T_c)	Apex Distance (E_c)	Arc length (L_c)	Deflection Angle $\Delta°$	Tangent Distance (T_c)	Apex Distance (E_c)	Arc length (L_c)
1	2	3	4	1	2	3	4
1°	0.87269	0.00381	1.74533	41°	37.38847	6 76094	71.55850
2°	1.74551	0.01523	3.49066	42°	38.38640	7.11450	73.30383
3°	2.61859	0.03428	5.23599	43°	39.39105	7.47862	75.04916
4°	3.49208	0.06095	6.98132	44°	40.40262	7.85347	76.79449
5°	4.36609	0.09527	8.72665	45°	41.42136	8.23922	78.53982
6°	5.24078	0.13723	10.47198	46°	42.44748	8.63604	80.28515
7°	6.11626	0.18687	12.21730	47°	43.48124	9.04411	82.03047
8°	6.99268	0.24419	13.96263	48°	44.52287	9.46363	83.77580
9°	7.87017	0.30922	15.70796	49°	45.57263	9.89479	85.52113
10°	8.74887	0,38198	17.45327	50°	46.63077	10.33779	87.26646
11°	9.62890	0.46251	19.19862	51°	47.69755	10.79285	89.01179
12°	10.51042	0.55083	20.94395	52°	48.77326	11.26019	90.75712
13°	11.39356	0.64697	22.68928	53°	49.85816	11.74004	92.50245
14°	12.27846	0.75098	22.43461	54°	50.95254	12.23262	94.24778
15°	13.16525	0.86290	26.17994	55°	52.05671	12.73819	95.93311
16°	13.05408	0.98276	27.92527	56°	53.17094	13.25701	97.73844
17°	14.94510	1.11061	29.67060	57°	54.29557	13.78932	99.48377
18°	15.83844	1.24653	31.41593	58°	55.43091	14.33541	101.22910
19°	16.73426	1.39051	33.16126	59°	56.57728	14.89555	102.97443
20°	17.63270	1.54266	34.90659	60°	57.73503	15.47005	104.71976
21°	18.53390	1.70303	36.65191	61°	58.90450	16 05921	106.46508
22°	19.43803	1.87167	38.39724	62°	60.08606	16.66334	108.21041
23°	20.34523	2.04866	40.14257	63°	61.28008	17.28277	109.95574
24°	21.25566	2.23406	41.88790	64°	62.48694	17.91784	111.70107
25°	22.16947	2.42795	43.63323	65°	63.70703	18.56890	113.44640
26°	23.08682	2.63041	45.37856	66°	64.94076	19.23633	115.19173
27°	24.00788	2 84152	47.12389	67°	66.18856	19.92049	116.93706
28°	24.93280	3.06136	48.86922	68°	67.45085	20.62179	118.68239
29°	25.86176	3.29003	50.61455	69°	68.72810	21.34064	120.42772
30°	26.79492	3.52762	52.35988	70°	70.02075	22.07746	122.17305
31°	27.73245	3.77422	54.10521	71°	71.32931	22.83269	123.91338
32°	28.67454	4.02994	55.85054	72°	72.65425	23.60680	125.66371
33°	29.62135	4.29489	57.59587	73°	73.99611	24.40026	127.40904
34°	30.57307	4.56918	59.34119	74°	75.35541	25.21357	129.15436
35°	31.52988	4.85291	61.08652	75°	76.73270	26.04724	130.89969
36°	32.49197	5.14622	62.83185	76°	78.12856	26.90182	132.64502
37°	33.45953	5.44923	64.57718	77°	79.54359	27.77787	134.39035
38°	34.43276	5.76207	66.32251	78°	80.97940	28.67596	136.13568
39°	35.41186	6.08487	68.06784	79°	82.43364	29.59670	137.88101
40°	36.39702	6.41778	69.81317	80°	83.90996	30.54073	139.62634

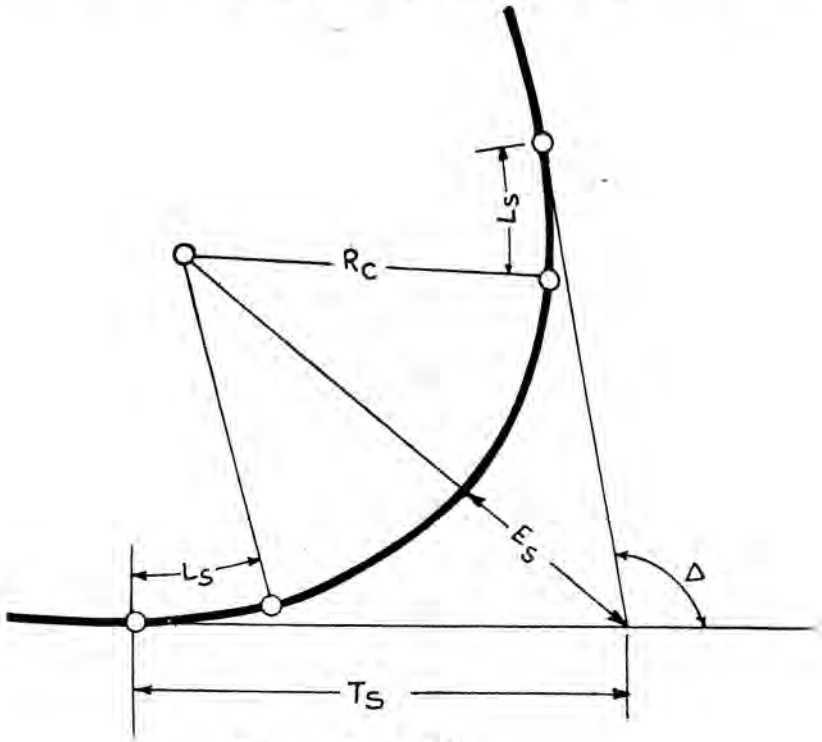
1	2	3	4	1	2	3	4
81°	85.40807	31 50870	141.37167	101°	121.30970	57.21337	176.27825
82°	86.92867	32.50130	143 11700	102°	123.48972	58.90157	178.02358
83°	88.47253	33.51924	144.86233	103°	125.71723	60.63879	179.76891
84°	90.04040	34.56327	146.60766	104°	127 99416	62.42692	181.51424
85°	91.63312	35.63417	148.35299	105°	130.32254	64.26796	183.25957
86°	93.25151	36 91859	150.09832	106°	132 70448	66.16401	185.60490
87°	94.89646	37.85985	151.84364	107°	135.14224	68.11730	186.75023
88°	96.56888	39.01636	153.58857	108°	137.63819	70.13016	188.49556
89°	98.26973	40.20321	155.33430	109°	140.11483	72.20508	190.29089
90°	100.00000	41 42136	157.07963	110°	142.81480	74.34468	191.98622
91°	101.76074	42.67182	158.82486	111°	145.50090	76.55173	193.73155
92°	103.55003	43 95565	160.57029	112°	148.25610	78.82916	195.47688
93°	105.37801	45.27397	162.31562	113°	151.08352	81.18010	197.22221
94°	107.23687	46.62792	164.06095	114°	153·98650	83.60785	198.96753
95°	109.13085	48.01872	165.80628	115°	156.96856	86.11590	200.71286
96°	111.06125	49 44765	167.55161	116°	160.03745	88.70799	202.45813
97°	113.02944	50.91605	169 29694	117°	163.18517	91.38809	204.20382
98°	115.03684	52.42531	171.04227	118°	166.42195	94.16040	205.94885
99°	117.08496	53.97690	172.78760	119°	169.76631	97.02944	207.69418
100°	119.17536	55 57238	174.53293	120°	173.28508	100.00000	209.43953

TABLE 17. PROPERTIES OF CIRCULAR CURVES-RADIUS, ARC DEFLECTION ANGLES AND CHORD DEFLECTION ANGLES

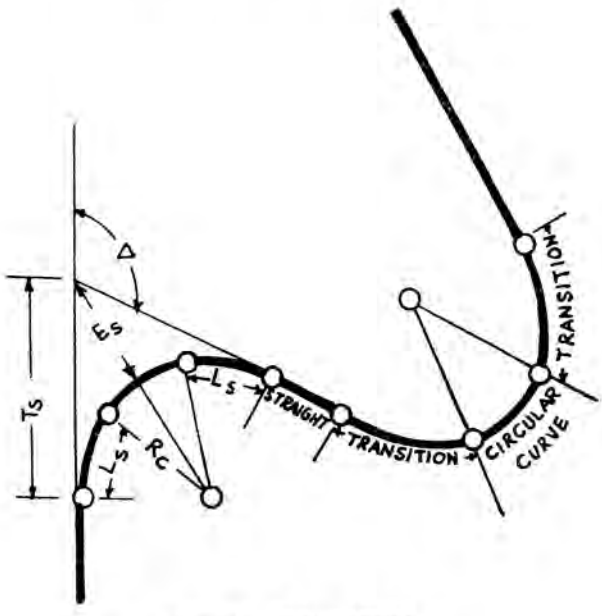
Radius	Chord Lengths for ARC of			Deflection—Angles for ARCS of				Deflection Angles for Chords of		
R_c (m)	10 m	20 m	50 m	1 m	10 m	20 m	50 m	10 m	20 m	50 m
15	9.8158	18.5510	29.8623	114.5912′	19°- 5′-54.77″	38°-11′-49.85″	95°-29′-34.63″	19°-28′-16.39″	41°-48′-37.13″	—
20	9.8962	19.1769	37.9593	85.9434′	14°-19′-26.19″	28°-38′-52.39″	71°-37′-10.97″	14°-28′-39.04″	30°- 0′- 0.00″	—
25	9.9334	19.4708	42.0735	68.7548′	11°-27′-32.95″	22°-55′- 5.91″	57°-17′-44.78″	11°-32′-13.05″	23°-34′-41.44″	90°
30	9.9537	19.6316	44.4105	57.2956′	9°-32′-57.46″	19°- 5′-54.92″	47°-44′-47.32″	9°-35′-38.64″	19°-28′-16.39″	56°-26′-33.66″
40	9.9739	19.7923	46.8076	42.9717′	7°- 9′-43.08″	14°-19′-26.19″	35°-48′-35.48″	7°-10 -50.72″	14°-28′-39.04″	38°- 0′-55.87″
45	9.9794	19.8358	47.4674	38.1972′	6°-21′-58.31″	12°-43′-56.62″	31°-49′-51.56″	6°-22′-45.73″	12°-50′-22.52″	33°-44′-56.36″
50	9.9833	19.8669	47.9426	34.3775′	5°-43′-46.48″	11°-27′-32.96′	28°-38′-52.40″	5°-44′-21.01″	11°-32′-13.05″	30°- 0′- 0.00″
55	9.9862	19.8900	48.2959	31.2522′	5°-12′-21.35″	10°-25′- 2.69″	26°- 2′-36.73″	5°-12′-57.27″	10°-28′-32.45″	27°- 2′- 8.49″
60	9.9884	19.9075	48.5657	28.6479′	4°-46′-28.73″	9°-32′-57.47″	23°-52′-23.67″	4°-46′-48.69″	9°-35′-38.65″	24°-37′-27.55″
70	9.9915	19.9320	48.9438	24.5553′	4°- 5′-33.20″	8°-11′- 6.40″	20°-27′-46.00″	4°- 5′-45.76″	8°-12′-47.56″	20°-55′-29.40″
80	9.9935	19.9480	49.1902	21.4859′	3°-34′-51.55″	7°- 9′-43.10°	17°-54′-17.75″	3°-34′-59.96″	7°-10′-50.72″	18°-12′-35.84″
90	9.9949	19.9589	49.3595	19.0986′	3°-10′-59.16″	6°-21′-58.31″	15°-54′-55.78″	3°-11′- 5.06″	6°-22′-45.73″	16°- 7′-39.43″
100	9.9958	19.8667	49.4608	17.1887′	2°-51′-53.24″	5°-43′-46.48″	14°-19′-26.20″	2°-51′-57.54″	5°-44′-21.01″	14°-28′-39.04″
125	9.9973	19.9787	49.6673	13.7510′	2°-17′-30.59″	4°-35′- 1.18″	11°-27′-32.96″	2°-17′-32.79″	4°-35′-18.84″	11°-32′-13.05″
150	9.9981	19.9852	49.7688	11.4592′	1°-54′-35.49″	3°-49′-10.99″	9°-32′-57.47″	1°-54′-36.77″	3°-49′-21.19″	9°-35′-38.65″
170	9.9986	19.9885	49.8200	10.1110′	1°-41′- 6.61″	3°-22′-13.22″	8°-25′-33.06″	1°-41′- 7.49″	3°-22′-20.23″	8°-27′-23.47″
200	9.9990	19.9917	49.8699	8.5944′	1°-25′-56.62″	2°-51′-53.24″	7°- 9′-43.10″	1°-25′-57.16″	2°-51′-57.54″	7°-10′-50.72″
250	9.9993	19.9947	49.9167	6.8755′	1°- 8′-45.30″	2°-17′-30.59″	5°-43′-46.48″	1°- 8′-45.57″	2°-17′-32.79″	5°-44′-21.01″
300	9.9995	19.9963	49·9421	5.7296′	0°-57′-17.75″	2°- 2′-46.60″	5°- 6′-56.50″	0°-57′-17.91″	1°-54′-36.77″	4°-46′-48.69″
350	9.9997	19.9973	49.9575	4.9111′	0°-49′- 6.64″	1°-38′-13.28″	4°- 5′-33.20″	0°-49′- 6.74″	1°-38′-14.08″	4°- 5′-45.76″
400	9.9997	19.9979	49.9675	4.3972′	0°-42′-58.31″	1°-25′-56.62″	3°-34′-51.55″	0°-42′-58.38″	1°-25′-57.16″	3°-34′-59.96″
500	9.9998	19.9987	49.9792	3.4377′	0°-34′-22.65″	1°- 8′-45.30″	2°-51′-53.24″	0°-34′-22.68″	1°- 8′-35.57″	2°-51′-57.54″
600	9.9999	19.9991	49.9855	2.3848′	0°-28′-38.87″	0°-57′-17.75″	2°-23′-14.37″	0°-28′-38.89″	0°-57′-17.91″	2°-23′-16.86″
700	9.9999	19.9993	49.9894	2.4555′	0°-24′-33.32″	0°-49′- 6.64″	2°- 2′-46.60″	0°-24′-33.33″	0°-49′- 6.74″	2°- 2′-48.17″
800	9.9999	19.9995	49.9919	2.1486′	0°-21′-29.16″	0°-42′-58.31″	1°-47′-25.78″	0°-21′-29.16″	0°-42′-58.38″	1°-47′-26.82″
900	9.9999	19.9996	49.9936	1.9099′	0°-19′- 5.92″	0°-38′-11.83″	1°- 5′-29.58″	0°-19′- 5.92″	0°-38′-11.88″	1°-35′-30.32″
1000	10.0000	19.9997	49.9948	1.7189′	0°-17′-11.32″	0°-34′-22.65″	1°-25′-56.62″	0°-17′-11.33″	0°-34′-22.68″	1°-25′-57.16″
1200	10.0000	19.9998	49.9964	1.4324′	0°-14′-19.44″	0°-28′-38.87″	1°-11′-37.18″	0°-14′-19.44″	0°-28′-38.89″	1°-11′-37.49″
1500	10.0000	19.9999	49.9977	1.1459′	0°-11′-27.55″	0°-22′-55.10″	0°-57′-17.75″	0°-11′-27.55″	0°-22′-55.11″	0°-57′-17.91″
1800	10.0000	19.9999	49.9984	0.9549′	0°- 9′-32.96″	0°-19′- 5.92″	0°-47′-44.79″	0°- 9′-32.96″	0°-19′- 5.92″	0°-47′-44.88″
2000	10.0000	19.9999	49.9987	0.8594′	0°- 8′-35.66″	0°-17′-11.32″	0°-42′-58.31″	0°- 8′-35.66″	0°-17′-11.33″	0°-42′-58.38″

Appendix 3

TABLE 10 : TABLE OF TANGENTS AND APEX DISTANCES FOR COMBINED AND TRANSITION CIRCULAR CURVES



PLAIN COUNTRY



HILLY COUNTRY

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 6 Degrees

$\Delta = 6°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	138.520	3.435	141.020	3.437	143.520	3.441	146.020	3.446	148.520	3.451	151.021	3.458	153.521	3.465	156.021	3.473	158.522	3.481	161.022	3.491	163.523	3.501	166.023	3.513	168.524	3.525	2500	
2200	122.797	3.023	125.297	3.027	127.798	3.031	130.298	3.036	132.798	3.042	135.299	3.050	137.799	3.058	140.299	3.067	142.800	3.077	145.300	3.087	147.801	3.099	150.302	3.112	152.802	3.126	2200	
2000	112.316	2.749	114.816	2.753	117.316	2.758	119.816	2.763	122.317	2.770	124.817	2.778	127.318	2.787	129.818	2.797	132.319	2.808	134.819	2.820	137.320	2.833	139.820	2.847	142.321	2.862	2000	
1800	101.834	2.475	104.334	2.479	106.835	2.485	109.335	2.491	111.835	2.499	114.336	2.507	116.836	2.517	119.337	2.528	121.837	2.540	124.338	2.553	126.839	2.568	129.339	2.584	131.840	2.601	1800	
1500	86.112	2.065	88.612	2.070	91.112	2.076	93.613	2.083	96.113	2.093	98.614	2.103	101.114	2.115	103.615	2.128	106.116	2.143	108.616	2.159	111.117	2.176	113.618	2.195	116.119	2.215	1500	
1200	70.390	1.655	72.890	1.661	75.390	1.668	77.891	1.678	80.391	1.689	82.892	1.703	85.393	1.717	87.893	1.734	90.394	1.752	92.895	1.772	95.396	1.794	97.897	1.817	100.398	1.842	1200	
1000	59.908	1.382	62.409	1.389	64.909	1.398	67.410	1.410	69.910	1.423	72.411	1.439	74.912	1.457	77.413	1.477	79.914	1.499	82.415	1.522	84.916	1.549	87.417	1.577	89.918	1.607	1000	
900	54.667	1.246	57.168	1.254	59.668	1.264	62.169	1.277	64.670	1.292	67.171	1.309	69.671	1.329	72.172	1.351	74.673	1.375	77.175	1.402	79.676	1.431	82.177	1.462	84.678	1.496	900	
800	49.427	1.110	51.927	1.119	54.428	1.130	56.928	1.145	59.429	1.162	61.930	1.181	64.431	1.203	66.932	1.228	69.433	1.256	71.935	1.286	74.436	1.318	75.937	1.353	79.439	1.391	800	
700	44.185	0.974	46.687	0.985	49.187	0.998	51.688	1.014	54.189	1.034	56.690	1.056	59.191	1.081	61.692	1.110	64.193	1.141	66.695	1.175	69.196	1.212	71.698	1.253	74.199	1.296	700	100 (P)*
600	38.945	0.839	41.446	0.851	43.947	0.867	46.448	0.886	48.949	0.908	51.450	0.935	53.951	0.964	56.452	0.997	58.954	1.034	61.455	1.074	63.957	1.117	66.459	1.164	68.960	1.215	600	
500	33.705	0.705	36.205	0.720	38.706	0.738	41.207	0.761	43.708	0.788	46.210	0.820	48.711	0.855	51.213	0.895	53.714	0.938	56.216	0.987	58.718	1.039	61.220	1.095	63.721	1.156	500	
400	28.464	0.573	30.965	0.591	33.466	0.614	35.967	0.643	38.469	0.677	40.970	0.716	43.472	0.760	45.973	0.810	48.475	0.864	50.977	0.925	53.479	0.990	55.981	1.060	58.483	1.135	400	
360	26.368	0.520	28.869	0.541	31.370	0.566	33.871	0.598	36.373	0.636	38.874	0.679	41.376	0.729	43.878	0.784	46.380	0.845	48.882	0.911	51.384	0.983	53.885	1.062	56.387	1.146	360	
350	25.844	0.507	28.345	0.528	30.846	0.555	33.347	0.588	35.849	0.626	38.351	0.671	40.852	0.722	43.354	0.778	45.856	0.841	48.358	0.909	50.860	0.984	53.362	1.064	55.863	1.151	350	
300	23.224	0.443	25.725	0.468	28.226	0.499	30.728	0.537	33.229	0.582	35.731	0.634	38.233	0.693	40.735	0.759	43.237	0.832	45.739	0.912	48.240	0.999	50.742	1.093	53.244	1.194	300	80 (P)*
250	20.604	0.381	23.105	0.410	25.606	0.447	28.108	0.493	30.610	0.548	33.112	0.610	35.614	0.681	38.115	0.760	40.617	0.848	43.119	0.944	45.621	1.048	48.122	1.160	50.623	1.281	250	
230	19.556	0.356	22.057	0.388	24.558	0.429	27.060	0.479	29.562	0.538	32.064	0.606	34.566	0.683	37.068	0.769	39.569	0.864	42.071	0.968	44.572	1.082	47.073	1.204	49.574	1.335	230	
200	17.984	0.321	20.485	0.358	22.987	0.405	25.489	0.462	27.990	0.530	30.492	0.608	32.994	0.697	35.496	0.796	37.997	0.905	40.498	1.025	42.999	1.155	45.499	1.296	47.999	1.446	200	
170	16.412	0.289	18.913	0.331	21.415	0.387	23.917	0.454	26.419	0.534	28.921	0.626	31.422	0.730	33.923	0.846	36.424	0.975	38.924	1.116	41.424	1.269	43.923	1.434	46.421	1.611	170	65 (P)*
155	15.626	0.273	18.127	0.320	20.629	0.381	23.131	0.455	25.633	0.542	28.135	0.643	30.636	0.757	33.137	0.885	35.637	1.026	38.136	1.180	40.635	1.348	43.133	1.529	45.629	1.724	155	
125	14.054	0.247	16.556	0.305	19.058	0.380	21.559	0.472	24.061	0.580	26.562	0.705	29.062	0.847	31.561	1.005	34.059	1.180	36.556	1.371	39.052	1.578	41.545	1.803	44.037	2.043	125	
100	12.744	0.231	15.246	0.304	17.748	0.398	20.249	0.512	22.750	0.648	25.249	0.804	27.747	0.981	30.243	1.178	32.737	1.396	35.229	1.634	37.719	1.893	40.205	2.173	42.688	2.472	100	
90	12.220	0.228	14.722	0.309	17.224	0.413	19.725	0.540	22.224	0.691	24.723	0.864	27.219	1.060	29.713	1.279	32.204	1.521	34.693	1.786	37.178	2.073	39.659	2.383	42.136	2.715	90	50 (P)*
80	11.697	0.227	14.198	0.318	16.699	0.435	19.200	0.579	21.698	0.748	24.195	0.942	26.689	1.163	29.179	1.409	31.667	1.681	34.150	1.978	36.629	2.300	39.103	2.648	41.572	3.021	80	50 (H)**
70	11.173	0.230	13.674	0.334	16.175	0.468	18.674	0.632	21.170	0.825	23.664	1.047	26.154	1.299	28.640	1.579	31.122	1.889	33.597	2.226	36.067	2.595	38.530	2.991	40.986	3.415	70	
60	10.649	0.239	13.150	0.360	15.649	0.516	18.146	0.707	20.639	0.932	23.129	1.191	25.613	1.483	28.091	1.810	30.562	2.170	33.026	2.564	35.481	2.990	37.927	3.449	40.363	3.940	60	40 (P)*
55	10.387	0.246	12.887	0.379	15.386	0.549	17.881	0.756	20.372	1.001	22.858	1.284	25.337	1.603	27.810	1.958	30.274	2.350	32.729	2.778	35.173	3.241	37.607	3.739	40.028	4.273	55	
50	10.123	0.256	12.625	0.402	15.122	0.589	17.615	0.817	20.102	1.086	22.584	1.396	25.057	1.746	27.522	2.136	29.976	2.566	32.419	3.034	34.850	3.542	37.267	4.087	39.669	4.669	50	40 (H)**
45	9.862	0.270	12.361	0.432	14.857	0.640	17.346	0.893	19.830	1.191	22.304	1.535	24.770	1.923	27.223	2.354	29.664	2.829	32.091	3.347	34.503	3.907	36.897	4.508	39.273	5.150	45	35 (P)*
40	9.600	0.289	12.097	0.471	14.590	0.705	17.075	0.989	19.552	1.324	22.017	1.709	24.470	2.143	26.909	2.632	29.331	3.158	31.735	3.735	34.119	4.360	36.482	5.029	38.822	5.742	40	35 (H) 30 (P)*
35	9.337	0.316	11.832	0.525	14.320	0.790	16.799	1.114	19.265	1.495	21.717	1.933	24.152	2.427	26.568	2.975	28.963	3.576	31.333	4.229	33.678	4.932	35.994	5.685	38.281	6.485	35	
33	9.231	0.329	11.725	0.549	14.211	0.831	16.686	1.175	19.147	1.579	21.592	2.042	24.017	2.564	26.421	3.142	28.800	3.777	31.153	4.465	33.477	5.206	35.769	5.998	38.027	6.838	33	
30	9.073	0.353	11.564	0.593	14.045	0.905	16.513	1.282	18.964	1.724	21.394	2.231	23.801	2.802	26.182	3.433	28.533	4.124	30.852	4.873	33.136	5.677	35.383	6.534	37.589	7.442	30	30 (H)**
25	8.807	0.409	11.292	0.698	13.761	1.068	16.210	1.517	18.633	2.043	21.028	2.644	23.388	3.318	25.710	4.061	27.991	4.870	30.225	5.743	32.410	6.675	34.543	7.663	36.621	8.703	25	
23	8.700	0.438	11.180	0.752	13.642	1.153	16.079	1.640	18.487	2.208	20.860	2.857	23.192	3.582	25.480	4.380	27.719	5.247	29.904	6.179	32.032	7.172	34.099	8.220			23	25 (P)*
20	8.538	0.494	11.009	0.855	13.454	1.313	15.868	1.868	18.241	2.514	20.568	3.249	22.843	4.066	25.059	4.961	27.212	5.929	29.296	6.962							20	25 (H)**
15	8.257	0.641	10.697	1.116	13.091	1.717	15.476	2.436	17.691	3.267	19.876	4.199	21.972	5.222													15	20 (P)*
14	8.197	0.6.3	10.627	1.190	13.004	1.830	15.312	2.594	17.542	3.473	19.680	4.455															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 6 Degrees

$\Delta = 6°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	171.075	3.538	173.525	3.551	176.026	3.566	178.527	3.582	181.027	3.598	183.528	3.615	186.029	3.633	188.530	3.652	191.031	3.671	193.532	3.692	196.033	3.713	198.534	3.735	201.035	3.758	2500	
2200	155.303	3.140	157.804	3.156	160.304	3.173	162.805	3.190	165.306	3.209	167.807	3.228	170.308	3.249	172.809	3.270	175.310	3.292	177.811	3.315	180.312	3.340	182.813	3.365	185.314	3.391	2200	
2000	144.822	2.878	147.323	2.896	149.824	2.914	152.324	2.933	154.825	2.953	157.326	2.975	159.827	2.997	162.328	3.021	164.829	3.045	167.330	3.071	169.832	3.097	172.333	3.125	174.834	3.153	2000	
1800	134.341	2.619	136.842	2.638	139.343	2.658	141.844	2.679	144.345	2.702	146.846	2.726	149.347	2.751	151.848	2.777	154.349	2.804	156.850	2.832	159.352	2.862	161.853	2.893	164.354	2.925	1800	
1500	118.620	2.237	121.121	2.260	123.622	2.284	126.123	2.310	128.624	2.337	131.126	2.365	133.627	2.395	136.128	2.427	138.629	2.459	141.131	2.493	143.632	2.529	146.134	2.565	148.635	2.604	1500	
1200	102.899	1.869	105.401	1.898	107.902	1.928	110.403	1.960	112.905	1.994	115.406	2.030	117.907	2.068	120.409	2.107	122.910	2.147	125.412	2.190	127.914	2.234	130.415	2.281	132.917	2.328	1200	
1000	92.420	1.639	94.921	1.674	97.422	1.710	99.924	1.749	102.425	1.790	104.927	1.832	107.429	1.877	109.930	1.924	112.432	1.973	114.934	2.024	117.435	2.077	119.937	2.133	122.439	2.190	1000	
900	87.180	1.532	89.681	1.570	92.183	1.611	94.684	1.653	97.186	1.699	99.688	1.746	102.189	1.796	104.691	1.848	107.193	1.903	109.695	1.959	112.197	2.018	114.699	2.080	117.200	2.144	900	
800	81.940	1.432	84.442	1.475	86.944	1.520	89.445	1.569	91.947	1.619	94.449	1.673	96.951	1.729	99.452	1.788	101.954	1.849	104.456	1.913	106.958	1.979	109.460	2.048	111.962	2.120	800	
700	76.701	1.342	79.203	1.391	81.704	1.443	84.206	1.499	86.708	1.557	89.210	1.617	91.712	1.682	94.214	1.749	96.716	1.819	99.218	1.892	101.719	1.968	104.221	2.047	106.723	2.128	700	
600	71.462	1.268	73.964	1.326	76.466	1.387	78.968	1.451	81.469	1.519	83.971	1.590	86.473	1.665	88.975	1.743	91.477	1.824	93.979	1.910	96.481	1.998	98.982	2.090	101.484	2.186	600	
500	66.223	1.220	68.725	1.289	71.227	1.362	73.729	1.439	76.231	1.520	78.733	1.606	81.235	1.695	83.736	1.789	86.238	1.887	88.740	1.989	91.241	2.095	93.742	2.206	96.244	2.321	500	
400	60.985	1.216	63.487	1.302	65.988	1.393	68.490	1.490	70.992	1.591	73.493	1.698	75.994	1.810	78.496	1.927	80.997	2.050	83.497	2.177	85.998	2.310	88.498	2.448	90.999	2.591	400	
360	58.889	1.236	61.391	1.331	63.892	1.432	66.394	1.539	68.895	1.652	71.396	1.771	73.897	1.895	76.398	2.025	78.899	2.161	81.399	2.303	83.899	2.451	86.398	2.604	88.897	2.762	360	100 (P)*
350	58.365	1.243	60.867	1.341	63.368	1.445	65.870	1.555	68.371	1.672	70.872	1.794	73.373	1.921	75.873	2.055	78.374	2.195	80.874	2.341	83.373	2.493	85.873	2.650	88.372	2.813	350	
300	55.745	1.301	58.246	1.416	60.747	1.537	63.248	1.666	65.749	1.801	68.249	1.943	70.749	2.093	73.248	2.249	75.747	2.412	78.246	2.582	80.744	2.758	83.241	2.942	85.738	3.133	300	
250	53.124	1.410	55.624	1.548	58.124	1.693	60.624	1.847	63.123	2.010	65.621	2.180	68.119	2.359	70.616	2.546	73.112	2.741	75.608	2.945	78.103	3.157	80.597	3.377	83.090	3.605	250	
230	52.074	1.475	54.574	1.625	57.073	1.783	59.572	1.950	62.070	2.127	64.567	2.312	67.064	2.506	69.559	2.709	72.054	2.922	74.548	3.143	77.041	3.373	79.533	3.612	82.024	3.859	230	80 (P)*
200	50.498	1.608	52.996	1.779	55.494	1.961	57.991	2.153	60.486	2.356	62.981	2.569	65.475	2.792	67.967	3.025	70.459	3.269	72.949	3.523	75.437	3.787	77.924	4.061	80.410	4.346	200	
170	48.918	1.801	51.414	2.003	53.908	2.216	56.402	2.442	58.894	2.680	61.384	2.930	63.873	3.192	66.360	3.466	68.845	3.752	71.329	4.050	73.810	4.360	76.289	4.681	78.766	5.015	170	
155	48.125	1.931	50.618	2.152	53.111	2.387	55.602	2.634	58.091	2.895	60.578	3.168	63.063	3.455	65.546	3.755	68.027	4.068	70.505	4.394	72.981	4.733	75.454	5.086	77.924	5.451	155	65 (P)*
125	46.526	2.300	49.013	2.573	51.498	2.863	53.980	3.169	56.459	3.490	58.935	3.828	61.408	4.183	63.877	4.553	66.343	4.939	68.804	5.341	71.262	5.758	73.715	6.192	76.164	6.641	125	
100	45.167	2.792	47.643	3.132	50.114	3.493	52.581	3.873	55.043	4.273	57.501	4.692	59.952	5.132	62.398	5.591	64.838	6.069	67.272	6.566	69.700	7.083	72.120	7.619	74.533	8.173	100	
90	44.609	3.070	47.077	3.446	49.539	3.845	51.996	4.266	54.447	4.709	56.891	5.173	59.329	5.659	61.759	6.166	64.183	6.694	66.598	7.244	69.005	7.814	71.404	8.405	73.794	9.016	90	50 (P)*
80	44.035	3.418	46.491	3.840	48.941	4.287	51.383	4.758	53.818	5.253	56.244	5.772	58.662	6.315	61.071	6.881	63.470	7.471	65.860	8.084	68.239	8.719	70.607	9.377	72.964	10.057	80	50 (H)**
70	43.434	3.867	45.874	4.346	48.305	4.853	50.726	5.388	53.136	5.949	55.536	6.537	57.925	7.151	60.302	7.792	62.666	8.458	65.018	9.149	67.356	9.865	69.680	10.605	71.989	11.370	70	
60	42.788	4.463	45.202	5.018	47.603	5.603	49.990	6.220	52.364	6.866	54.723	7.543	57.067	8.249	59.394	8.983	61.705	9.746	63.998	10.536	66.273	11.354	68.529	12.198	70.766	13.068	60	40 (P)*
55	42.437	4.640	44.831	5.441	47.211	6.075	49.575	6.742	51.922	7.442	54.251	8.172	56.563	8.934	58.855	9.725	61.127	10.547	63.379	11.397	65.609	12.275	67.818	13.181	70.003	14.113	55	
50	42.055	4.289	44.425	5.945	46.776	6.636	49.108	7.362	51.421	8.122	53.712	8.915	55.981	9.740	58.228	10.598	60.450	11.486	62.648	12.403	64.821	13.350	66.967	14.324	69.087	15.326	50	40 (H)**
45	41.630	5.831	43.965	6.551	46.279	7.309	48.569	8.104	50.834	8.935	53.074	9.801	55.287	10.701	57.473	11.633	59.629	12.597	61.756	13.591	63.852	14.614	65.917	15.665	67.950	16.742	45	35 (P)*
40	41.137	6.497	43.425	7.295	45.686	8.132	47.918	9.009	50.119	9.923	52.288	10.873	54.424	11.857	56.526	12.875	58.593	13.924	60.623	15.003							40	35 (H)**
35	40.536	7.331	42.757	8.221	44.942	9.154	47.090	10.126	49.200	11.137	51.269	12.184															35	
33	40.250	7.726	42.436	8.658	44.582	9.633	46.686	10.648	48.748	11.701																	33	30 (P)*
30	39.753	8.398	41.872	9.399	43.945	10.443																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 7 Degrees

$\Delta = 7°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	160.407	4.677	162.907	4.680	165.407	4.684	167.907	4.688	170.408	4.694	172.908	4.700	175.408	4.707	177.909	4.715	180.409	4.724	182.910	4.733	185.411	4.743	187.911	4.755	190.412	4.767	2500	
2200	142.058	4.116	144.558	4.120	147.058	4.124	149.559	4.129	152.059	4.135	154.559	4.143	157.060	4.151	159.560	4.160	162.061	4.170	164.562	4.180	167.062	4.192	169.563	4.205	172.064	4.219	2200	
2000	129.825	3.743	132.326	3.747	134.826	3.751	137.326	3.757	139.827	3.764	142.327	3.772	144.828	3.781	147.328	3.791	149.829	3.802	152.329	3.813	154.830	3.827	157.331	3.841	159.832	3.856	2000	
1800	117.593	3.370	120.093	3.374	122.593	3.379	125.094	3.385	127.594	3.393	130.095	3.402	132.595	3.412	135.096	3.423	137.597	3.435	140.097	3.448	142.598	3.463	145.099	3.478	147.600	3.495	1800	
1500	99.244	2.810	101.745	2.815	104.245	2.821	106.745	2.829	109.246	2.838	111.746	2.848	114.247	2.860	116.748	2.873	119.249	2.888	121.750	2.904	124.251	2.921	126.752	2.940	129.253	2.960	1500	
1200	80.896	2.251	83.396	2.257	85.896	2.265	88.397	2.274	90.898	2.286	93.398	2.299	95.899	2.313	98.400	2.330	100.901	2.348	103.402	2.368	105.903	2.390	108.404	2.414	110.906	2.439	1200	
1000	68.663	1.878	71.164	1.886	73.664	1.895	76.165	1.907	78.665	1.920	81.166	1.936	83.667	1.954	86.168	1.974	88.670	1.995	91.171	2.019	93.672	2.046	96.174	2.074	98.675	2.104	1000	
900	62.547	1.693	65.047	1.701	67.548	1.711	70.049	1.724	72.550	1.739	75.050	1.756	77.552	1.776	80.053	1.798	82.554	1.823	85.055	1.849	87.557	1.878	90.058	1.909	92.560	1.943	900	
800	56.431	1.507	58.931	1.516	61.432	1.528	63.933	1.542	66.434	1.559	68.935	1.579	71.436	1.601	73.937	1.626	76.439	1.653	78.940	1.683	81.442	1.716	83.943	1.751	86.445	1.789	800	
700	50.315	1.322	52.815	1.333	55.316	1.346	57.817	1.362	60.318	1.382	62.819	1.404	65.320	1.429	67.822	1.458	70.323	1.489	72.825	1.523	75.327	1.560	77.829	1.601	80.331	1.644	700	100 (P)*
600	44.198	1.137	46.699	1.149	49.200	1.165	51.701	1.184	54.202	1.207	56.704	1.233	59.205	1.262	61.707	1.295	64.208	1.332	66.710	1.372	69.212	1.416	71.714	1.462	74.217	1.513	600	
500	38.082	0.953	40.583	0.968	43.084	0.987	45.585	1.010	48.087	1.037	50.588	1.068	53.090	1.104	55.592	1.143	58.094	1.187	60.596	1.233	63.098	1.287	65.601	1.344	68.103	1.404	500	
400	31.966	0.771	34.467	0.790	36.969	0.813	39.470	0.842	41.972	0.875	44.474	0.915	46.976	0.959	49.478	1.009	51.980	1.063	54.482	1.123	56.985	1.188	59.487	1.259	61.990	1.334	400	
360	29.520	0.699	32.021	0.719	34.522	0.745	37.024	0.777	39.526	0.815	42.028	0.858	44.530	0.908	47.032	0.963	49.535	1.024	52.037	1.090	54.540	1.163	57.042	1.241	59.545	1.325	360	
350	28.908	0.681	31.410	0.702	33.911	0.729	36.413	0.762	38.914	0.800	41.416	0.845	43.919	0.896	46.421	0.952	48.923	1.015	51.426	1.083	53.928	1.158	56.431	1.238	58.935	1.325	350	
300	25.851	0.592	28.352	0.616	30.853	0.648	33.355	0.686	35.857	0.731	38.359	0.783	40.862	0.843	43.364	0.909	45.867	0.981	48.369	1.062	50.872	1.148	53.374	1.242	55.877	1.343	300	80 (P)*
250	22.793	0.505	25.294	0.534	27.796	0.572	30.298	0.618	32.800	0.672	35.303	0.734	37.805	0.805	40.308	0.885	42.810	0.972	45.313	1.068	47.815	1.172	50.318	1.285	52.820	1.406	250	
230	21.570	0.471	24.071	0.503	26.573	0.543	29.075	0.593	31.578	0.652	34.080	0.720	36.583	0.797	39.085	0.883	41.588	0.979	44.090	1.083	46.593	1.196	49.095	1.319	51.596	1.450	230	
200	19.735	0.421	22.237	0.457	24.739	0.504	27.241	0.562	29.744	0.629	32.246	0.708	34.749	0.796	37.251	0.895	39.754	1.005	42.256	1.125	44.758	1.255	47.259	1.395	49.760	1.546	200	
170	17.921	0.373	20.402	0.416	22.905	0.471	25.407	0.539	27.910	0.618	30.412	0.710	32.915	0.815	35.417	0.931	37.919	1.060	40.420	1.201	42.921	1.354	45.422	1.519	47.921	1.697	170	65 (P)*
155	16.983	0.350	19.485	0.397	21.988	0.458	24.490	0.532	26.993	0.619	29.495	0.720	31.998	0.835	34.500	0.962	37.001	1.104	39.502	1.258	42.002	1.426	44.501	1.607	46.999	1.801	155	
125	15.149	0.309	17.651	0.367	20.154	0.442	22.656	0.534	25.159	0.642	27.661	0.768	30.162	0.909	32.663	1.067	35.163	1.242	37.661	1.433	40.158	1.641	42.654	1.865	45.147	2.106	125	
100	13.621	0.281	16.123	0.354	18.626	0.448	21.128	0.562	23.630	0.695	26.130	0.841	28.630	1.011	31.128	1.228	33.624	1.446	36.118	1.685	38.609	1.944	41.098	2.223	43.584	2.523	100	
90	13.009	0.273	15.512	0.354	18.014	0.458	20.516	0.585	23.017	0.736	25.517	0.909	28.015	0.105	30.511	1.325	33.005	1.567	35.495	1.831	37.983	2.119	40.467	2.429	42.947	2.761	90	50 (P)*
80	12.398	0.267	14.901	0.358	17.403	0.475	19.904	0.619	22.404	0.788	24.902	0.983	27.398	1.203	29.891	1.450	32.381	1.721	34.867	2.019	37.349	2.341	39.826	2.689	42.298	3.062	80	50 (H)**
70	11.787	0.265	14.289	0.369	16.791	0.503	19.291	0.667	21.789	0.860	24.285	1.082	26.778	1.334	29.266	1.615	31.750	1.925	34.229	2.264	36.702	2.631	39.169	3.027	41.628	3.451	70	
60	11.175	0.269	13.677	0.390	16.178	0.546	18.677	0.737	21.172	0.962	23.664	1.221	26.150	1.514	28.631	1.841	31.106	2.201	33.573	2.595	36.032	3.021	38.482	3.480	40.922	3.972	60	40 (P)*
55	10.870	0.273	13.371	0.406	15.871	0.576	18.368	0.784	20.862	1.029	23.350	1.311	25.832	1.631	28.308	1.986	30.775	2.378	33.234	2.806	35.683	3.270	38.121	3.769	40.547	4.302	55	
50	10.564	0.281	13.065	0.427	15.564	0.614	18.059	0.842	20.549	1.112	23.033	1.422	25.510	1.772	27.978	2.162	30.436	2.592	32.883	3.061	35.318	3.568	37.740	4.114	40.147	4.697	50	40 (H)**
45	10.258	0.293	12.758	0.455	15.256	0.662	17.748	0.916	20.233	1.214	22.711	1.558	25.180	1.946	27.637	2.378	30.083	2.853	32.514	3.371	34.930	3.931	37.330	4.533	39.712	5.175	45	35 (P)*
40	9.952	0.309	12.451	0.491	14.946	0.725	17.434	1.009	19.913	1.344	22.382	1.730	24.838	2.164	27.282	2.648	29.708	3.179	32.118	3.757	34.507	4.382	36.876	5.051	39.222	5.764	40	35 (H) 30 (P)*
35	9.646	0.333	12.143	0.541	14.633	0.807	17.114	1.132	19.584	1.514	22.040	1.952	24.480	2.445	26.900	2.993	29.300	3.595	31.676	4.248	34.027	4.952	36.350	5.705	38.644	6.506	35	
33	9.523	0.346	12.019	0.566	14.507	0.848	16.985	1.192	19.449	1.596	21.898	2.059	24.328	2.581	26.737	3.160	29.122	3.795	31.481	4.484	33.811	5.225	36.110	6.017	38.376	6.858	33	
30	9.338	0.368	11.832	0.610	14.316	0.920	16.787	1.297	19.241	1.740	21.676	2.247	24.088	2.818	26.474	3.450	28.832	4.141	31.157	4.890	33.448	5.695	35.702	6.552	37.916	7.461	30	30 (H)**
25	9.029	0.421	11.517	0.711	13.989	1.081	16.441	1.530	18.870	2.057	21.269	2.658	23.636	3.332	25.964	4.075	28.252	4.885	30.494	5.758	32.687	6.691	34.829	7.679	36.915	8.719	25	
23	8.905	0.450	11.388	0.764	13.853	1.165	16.295	1.652	18.707	2.221	21.086	2.870	23.425	3.595	25.719	4.394	27.966	5.261	30.159	6.194	32.296	7.187	34.372	8.236			23	25 (P)*
20	8.717	0.505	11.191	0.865	13.641	1.324	16.059	1.879	18.438	2.525	20.772	3.260	23.051	4.078	25.278	4.974	27.439	5.942	29.532	6.976							20	25 (H)**
15	8.393	0.649	10.838	1.124	13.237	1.725	15.579	2.445	17.851	3.276	20.044	4.208	22.149	5.232													15	20 (P)*
14	8.326	0.690	10.760	1.197	13.142	1.838	15.458	2.602	17.694	3.482	19.841	4.464															14	20 (H)**

*P = Plain & Rolling Terrain **H - Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 7 Degrees

△=7°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	192.913	4.780	195.413	4.794	197.914	4.808	200.415	4.824	202.916	4.840	205.417	4.857	207.918	4.875	210.419	4.894	212.920	4.913	215.421	4.934	217.922	4.955	220.423	4.977	222.925	5.000	2500	
2200	174.565	4.234	177.065	4.249	179.566	4.266	182.067	4.283	184.568	4.302	187.069	4.321	189.570	4.342	192.072	4.363	194.573	4.385	197.074	4.409	199.575	4.433	202.077	4.458	204.578	4.484	2200	
2000	162.333	3.872	164.834	3.889	167.335	3.907	169.836	3.927	172.337	3.947	174.838	3.969	177.339	3.991	179.840	4.014	182.342	4.039	184.843	4.064	187.344	4.091	189.846	4.119	192.347	4.147	2000	
1800	150.101	3.513	152.602	3.532	155.103	3.552	157.604	3.574	160.105	3.596	162.607	3.620	165.108	3.645	167.609	3.671	170.111	3.698	172.612	3.727	175.114	3.756	177.615	3.787	180.117	3.819	1800	
1500	131.754	2.982	134.255	3.005	136.756	3.029	139.258	3.055	141.759	3.082	144.260	3.111	146.762	3.141	149.263	3.172	151.765	3.204	154.267	3.239	156.768	3.274	159.270	3.311	161.772	3.349	1500	
1200	113.407	2.466	115.909	2.494	118.410	2.525	120.912	2.557	123.413	2.591	125.915	2.626	128.417	2.664	130.919	2.703	133.421	2.744	135.923	2.787	138.425	2.831	140.927	2.877	143.429	2.925	1200	
1000	101.177	2.136	103.678	2.171	106.180	2.207	108.682	2.246	111.184	2.287	113.686	2.329	116.188	2.374	118.690	2.421	121.192	2.470	123.694	2.521	126.196	2.575	128.699	2.630	131.201	2.685	1000	
900	95.062	1.979	97.564	2.017	100.065	2.058	102.567	2.101	105.069	2.146	107.572	2.194	110.074	2.243	112.576	2.295	115.078	2.350	117.580	2.407	120.083	2.466	122.585	2.527	125.088	2.591	900	
800	88.947	1.829	91.449	1.872	93.951	1.918	96.453	1.966	98.955	2.017	101.458	2.071	103.960	2.127	106.462	2.185	108.965	2.247	111.467	2.311	113.970	2.377	116.472	2.446	118.975	2.518	800	
700	82.833	1.690	85.335	1.739	87.837	1.792	90.339	1.846	92.842	1.905	95.344	1.966	97.847	2.030	100.349	2.097	102.852	2.167	105.354	2.240	107.857	2.316	110.359	2.395	112.862	2.477	700	
600	76.719	1.567	79.221	1.624	81.723	1.685	84.226	1.750	86.728	1.817	89.231	1.888	91.734	1.963	94.236	2.042	96.739	2.123	99.241	2.208	101.744	2.297	104.246	2.389	106.749	2.484	600	
500	70.605	1.469	73.108	1.538	75.610	1.611	78.113	1.688	80.616	1.769	83.118	1.855	85.621	1.944	88.123	2.038	90.626	2.136	93.128	2.238	95.631	2.345	98.133	2.455	100.635	2.570	500	
400	64.492	1.416	66.995	1.501	69.498	1.593	72.000	1.689	74.503	1.791	77.005	1.897	79.507	2.010	82.010	2.127	84.512	2.249	87.014	2.377	89.515	2.510	92.017	2.648	94.518	2.791	400	
360	62.047	1.415	64.550	1.510	67.052	1.612	69.555	1.719	72.057	1.832	74.559	1.950	77.061	2.075	79.563	2.205	82.065	2.341	84.566	2.483	87.067	2.630	89.568	2.783	92.069	2.943	360	100 (P)*
350	61.436	1.417	63.939	1.515	66.441	1.620	68.943	1.730	71.446	1.846	73.948	1.968	76.450	2.096	78.951	2.230	80.453	2.370	83.954	2.516	86.455	2.667	88.956	2.825	91.456	2.989	350	
300	58.379	1.451	60.882	1.565	63.384	1.687	65.886	1.815	68.387	1.951	70.889	2.093	73.390	2.242	75.891	2.399	78.391	2.562	80.891	2.731	83.391	2.908	85.890	3.092	88.388	3.283	300	
250	55.322	1.535	57.823	1.672	60.325	1.818	62.825	1.972	65.326	2.135	67.826	2.305	70.325	2.484	72.824	2.671	75.322	2.867	77.820	3.071	80.316	3.282	82.812	3.503	85.307	3.731	250	
230	54.098	1.590	56.599	1.740	59.100	1.898	61.600	2.065	64.099	2.242	66.598	2.427	69.097	2.622	71.594	2.825	74.091	3.037	76.587	3.258	79.081	3.488	81.575	3.728	84.068	3.976	230	80 (P)*
200	52.261	1.708	54.761	1.879	57.260	2.061	59.758	2.254	62.256	2.456	64.752	2.669	67.248	2.893	69.742	3.126	72.236	3.370	74.728	3.624	77.219	3.888	79.708	4.162	82.196	4.447	200	
170	50.420	1.886	52.917	2.088	55.414	2.302	57.909	2.528	60.403	2.766	62.896	3.016	65.387	3.278	67.876	3.552	70.364	3.838	72.850	4.136	75.334	4.446	77.816	4.768	80.296	5.102	170	
155	49.497	2.000	51.992	2.230	54.487	2.465	56.980	2.712	59.471	2.973	61.961	3.247	64.448	3.534	66.934	3.834	69.417	4.147	71.898	4.473	74.377	4.813	76.853	5.165	79.327	5.530	155	65 (P)*
125	47.639	2.362	50.129	2.637	52.616	2.926	55.101	3.232	57.583	3.554	60.061	3.892	62.537	4.247	65.010	4.617	67.479	5.003	69.944	5.405	72.405	5.823	74.862	6.257	77.315	6.706	125	
100	46.066	2.843	48.545	3.184	51.019	3.544	53.489	3.924	55.955	4.324	58.416	4.744	60.871	5.184	63.321	5.643	65.766	6.121	68.204	6.619	70.636	7.136	73.061	7.672	75.479	8.227	100	
90	45.423	3.116	47.894	3.493	50.360	3.892	52.820	4.313	55.275	4.756	57.723	5.220	60.165	5.706	62.600	6.214	65.028	6.742	67.448	7.292	69.860	7.863	72.264	8.454	74.660	9.065	90	50 (P)*
80	44.764	3.459	47.224	3.882	49.678	4.329	52.124	4.800	54.563	5.295	56.994	5.815	59.417	6.358	61.831	6.924	64.235	7.514	66.630	8.127	69.014	8.763	71.389	9.421	73.752	10.102	80	50 (H)**
70	44.080	3.903	46.524	4.383	48.959	4.891	51.385	5.425	53.800	5.987	56.206	6.575	58.600	7.190	60.982	7.830	63.352	8.496	65.710	9.188	68.054	9.904	70.384	10.645	72.700	11.411	70	
60	43.352	4.495	45.770	5.050	48.176	5.636	50.569	6.253	52.949	6.900	55.314	7.576	57.663	8.282	59.997	9.017	62.315	9.781	64.615	10.571	66.897	11.389	69.160	12.234	71.404	13.105	60	40 (P)*
55	42.960	4.870	45.420	5.471	47.745	6.106	50.114	6.673	52.468	7.473	54.804	8.204	57.122	8.965	59.421	9.758	61.700	10.579	63.960	11.430	66.198	12.309	68.414	13.215	70.607	14.147	55	
50	42.539	5.316	44.914	5.972	47.271	6.664	49.610	7.390	51.929	8.150	54.227	8.944	56.504	9.770	58.758	10.628	60.988	11.516	63.194	12.434	65.375	13.381	67.530	14.356	69.658	15.358	50	40 (H)**
45	42.074	5.856	44.416	6.577	46.736	7.335	49.033	8.131	51.306	7.962	53.553	9.828	55.774	10.729	57.968	11.661	60.133	12.625	62.268	13.620	64.374	14.644	66.448	15.695	68.489	16.773	45	35 (P)*
40	41.543	6.520	43.839	7.318	46.107	8.156	48.346	9.033	50.555	9.947	52.733	10.898	54.878	11.883	56.989	12.901	59.064	13.951	61.104	15.031							40	30 (H)**
35	40.906	7.352	43.135	8.243	45.328	9.176	48.485	10.148	49.306	11.160	51.681	12.207															35	
33	40.607	7.746	42.800	8.678	44.954	9.654	47.068	10.670	49.139	11.723																	33	30 (P)*
30	40.089	8.417	42.217	9.419	44.298	10.463																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P Plain & Rolling Terrian **H Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 8 Degrees

$\Delta = 8°$

R_C	$L_S = 15$ metres		$L_S = 20$ metres		$L_S = 25$ metres		$L_S = 30$ metres		$L_S = 35$ metres		$L_S = 40$ metres		$L_S = 45$ metres		$L_S = 50$ metres		$L_S = 55$ metres		$L_S = 60$ metres		$L_S = 65$ metres		$L_S = 70$ metres		$L_S = 75$ metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre			
2500	182.317	6.110	184.817	6.113	187.318	6.116	189.818	6.121	192.318	6.126	194.819	6.133	197.319	6.140	199.820	6.148	202.320	6.156	204.821	6.166	207.322	6.176	209.822	6.188	212.323	6.200	2500	
2200	161.339	5.377	163.839	5.381	166.340	5.385	168.840	5.390	171.341	5.396	173.841	5.404	176.342	5.412	178.842	5.421	181.343	5.431	183.844	5.441	186.344	5.453	188.845	5.466	191.346	5.480	2200	
2000	147.354	4.839	149.854	4.893	152.354	4.898	154.855	4.904	157.355	4.910	159.856	4.918	162.356	4.927	164.857	4.937	167.358	4.948	169.859	4.960	172.359	4.973	174.860	4.987	177.361	5.002	2000	
1800	133.369	4.401	135.869	4.406	138.369	4.411	140.870	4.417	143.370	4.425	145.871	4.433	148.371	4.443	150.872	4.454	153.373	4.467	155.874	4.480	158.375	4.494	160.876	4.510	163.377	4.527	1800	
1500	112.391	3.670	114.891	3.675	117.391	3.681	119.892	3.688	122.393	3.698	124.893	3.708	127.394	3.720	129.895	3.733	132.396	3.748	134.897	3.764	137.398	3.781	139.899	3.800	142.400	3.820	1500	
1200	91.413	2.939	93.913	2.945	96.414	2.953	98.914	2.962	101.415	2.973	103.916	2.987	106.417	3.001	108.918	3.018	111.419	3.036	113.920	3.056	116.422	3.078	118.923	3.101	121.425	3.127	1200	
1000	77.427	2.452	79.928	2.459	82.429	2.469	84.929	2.480	87.430	2.493	89.931	2.509	92.432	2.527	94.934	2.547	97.435	2.569	99.936	2.593	102.438	2.619	104.940	2.647	107.441	2.677	1000	
900	70.435	2.209	72.935	2.217	75.436	2.227	77.937	2.240	80.438	2.255	82.939	2.272	85.440	2.292	87.942	2.314	90.443	2.339	92.945	2.365	95.446	2.394	97.948	2.426	100.450	2.459	900	
800	63.442	1.966	65.943	1.975	68.444	1.986	70.945	2.001	73.446	2.018	75.947	2.037	78.448	2.060	80.950	2.084	83.451	2.112	85.953	2.142	88.455	2.174	90.957	2.210	93.459	2.248	800	
700	56.450	1.723	58.950	1.734	61.451	1.747	63.952	1.763	66.453	1.783	68.955	1.805	71.456	1.831	73.958	1.859	76.460	1.890	78.962	1.925	81.464	1.962	83.966	2.002	86.469	2.045	700	100 (P)*
600	49.457	1.481	51.958	1.493	54.459	1.509	56.960	1.528	59.462	1.551	61.963	1.577	64.465	1.606	66.967	1.639	69.469	1.676	71.971	1.716	74.473	1.760	76.976	1.807	79.479	1.857	600	
500	42.465	1.240	44.966	1.255	47.467	1.273	49.968	1.296	52.470	1.323	54.972	1.355	57.474	1.390	59.976	1.430	62.478	1.474	64.981	1.522	67.483	1.574	69.986	1.630	72.489	1.691	500	
400	35.472	1.000	37.973	1.019	40.475	1.042	42.977	1.071	45.479	1.105	47.981	1.144	50.483	1.188	52.986	1.238	55.488	1.293	57.991	1.353	60.494	1.418	62.997	1.489	65.501	1.564	400	
360	32.675	0.906	35.177	0.926	37.678	0.952	40.180	0.984	42.682	1.021	45.185	1.065	47.687	1.114	50.190	1.169	52.693	1.230	55.196	1.297	57.699	1.369	60.202	1.448	62.706	1.532	360	
350	31.976	0.882	34.477	0.903	36.979	0.929	39.481	0.962	41.983	1.001	44.486	1.046	46.988	1.096	49.491	1.153	51.994	1.216	54.497	1.284	57.000	1.359	59.503	1.439	62.007	1.526	350	
300	28.480	0.764	30.982	0.789	33.483	0.820	35.986	0.858	38.488	0.903	40.991	0.955	43.493	1.015	45.997	1.081	48.500	1.154	51.003	1.234	53.506	1.321	56.010	1.415	58.513	1.515	300	80 (P)*
250	24.984	0.648	27.486	0.677	29.988	0.715	32.490	0.761	34.993	0.815	37.496	0.878	39.999	0.949	42.502	1.028	45.006	1.116	47.509	1.212	50.013	1.316	52.516	1.429	55.019	1.550	250	
230	23.586	0.603	26.088	0.634	28.590	0.675	31.092	0.725	33.595	0.784	36.098	0.852	38.602	0.929	41.105	1.016	43.608	1.111	46.112	1.215	48.615	1.328	51.118	1.451	53.621	1.582	230	
200	21.488	0.535	23.990	0.572	26.493	0.619	28.996	0.676	31.499	0.744	34.002	0.823	36.505	0.911	39.009	1.010	41.512	1.120	44.015	1.240	46.518	1.370	49.021	1.511	51.523	1.662	200	
170	19.391	0.470	21.893	0.513	24.396	0.569	26.899	0.636	29.402	0.716	31.906	0.808	34.409	0.912	36.912	1.029	39.415	1.158	41.918	1.299	44.420	1.452	46.922	1.617	49.423	1.795	170	65 (P)*
155	18.342	0.439	20.845	0.486	23.348	0.547	25.851	0.621	28.354	0.709	30.858	0.809	33.361	0.924	35.864	1.052	38.367	1.193	40.869	1.347	43.370	1.515	45.871	1.697	48.371	1.891	155	
125	16.245	0.380	18.748	0.439	21.251	0.514	23.753	0.606	26.258	0.714	28.761	0.839	31.264	0.981	33.766	1.139	36.267	1.314	38.767	1.506	41.266	1.714	43.763	1.938	46.259	2.179	125	
100	14.498	0.338	17.001	0.411	19.504	0.505	22.008	0.620	24.510	0.735	27.013	0.912	29.514	1.089	32.013	1.286	34.511	1.504	37.007	1.743	39.501	2.002	41.992	2.282	44.481	2.582	100	
90	13.799	0.324	16.302	0.405	18.805	0.510	21.309	0.637	23.811	0.788	26.312	0.961	28.812	1.158	31.310	1.377	33.806	1.619	36.299	1.884	38.789	2.171	41.275	2.482	43.758	2.814	90	50 (P)*
80	13.100	0.313	15.603	0.404	18.107	0.521	20.609	0.665	23.111	0.834	25.611	1.029	28.109	1.250	30.604	1.496	33.096	1.768	35.585	2.066	38.069	2.388	40.549	2.736	43.024	3.109	80	50 (H)**
70	12.401	0.305	14.905	0.409	17.408	0.543	19.909	0.707	22.409	0.900	24.907	1.123	27.402	1.375	29.893	1.656	32.379	1.966	34.861	2.305	37.337	2.673	39.807	3.069	42.271	3.493	70	
60	11.703	0.303	14.206	0.425	16.708	0.581	19.208	0.772	21.705	0.997	24.199	1.256	26.688	1.549	29.172	1.876	31.650	2.237	34.121	2.630	36.583	3.057	39.037	3.516	41.482	4.008	60	40 (P)*
55	11.353	0.305	13.856	0.438	16.358	0.608	18.856	0.816	21.352	1.061	23.842	1.344	26.328	1.663	28.806	2.019	31.277	2.411	33.740	2.839	36.192	3.303	38.635	3.802	41.065	4.336	55	
50	11.004	0.310	13.506	0.456	16.007	0.643	18.504	0.872	20.996	1.141	23.483	1.451	25.962	1.802	28.434	2.192	30.896	2.622	33.347	3.091	35.786	3.599	38.213	4.145	40.625	4.728	50	40 (H)**
45	10.654	0.319	13.156	0.481	15.655	0.688	18.149	0.942	20.638	1.241	23.119	1.585	25.590	1.973	28.052	2.405	30.501	2.881	32.937	3.399	35.358	3.959	37.763	4.561	40.151	5.203	45	35 (P)*
40	10.305	0.332	12.805	0.514	15.302	0.748	17.792	1.033	20.275	1.368	22.747	1.754	25.208	2.188	27.655	2.672	30.086	3.204	32.500	3.782	34.895	4.407	37.270	5.077	39.622	5.790	40	35 (H) 30 (P)*
35	9.955	0.354	12.453	0.561	14.946	0.828	17.430	1.153	19.904	1.534	22.363	1.973	24.807	2.467	27.233	3.015	29.637	3.617	32.020	4.271	34.376	4.975	36.706	5.729	39.007	6.530	35	
33	9.815	0.365	12.312	0.585	14.803	0.868	17.284	1.211	19.752	1.616	22.205	2.079	24.639	2.602	27.053	3.181	29.443	3.816	31.808	4.505	34.145	5.247	36.451	6.039	38.724	6.881	33	
30	9.604	0.386	12.100	0.628	14.586	0.938	17.060	1.315	19.519	1.758	21.958	2.266	24.375	2.837	26.767	3.469	29.130	4.161	31.463	4.910	33.761	5.715	36.022	6.573	38.244	7.482	30	30 (H)**
25	9.252	0.436	11.741	0.726	14.217	1.096	16.674	1.546	19.106	2.072	21.511	2.674	23.883	3.348	26.219	4.092	28.513	4.902	30.763	5.776	32.965	6.709	35.115	7.698	37.210	8.739	25	
23	9.110	0.463	11.596	0.778	14.065	1.179	16.510	1.666	18.928	2.235	21.312	2.885	23.657	3.610	25.959	4.409	28.213	5.277	30.414	6.211	32.560	7.204	34.646	8.254			23	25 (P)*
20	8.896	0.516	11.374	0.877	13.822	1.336	16.250	1.891	18.635	2.538	20.975	3.273	23.264	4.092	25.496	4.988	27.666	5.956	29.768	6.991							20	25 (H)**
15	8.530	0.658	10.979	1.133	13.384	1.734	15.731	2.455	18.011	3.287	20.212	4.219	22.326	5.243													15	20 (P)*
14	8.454	0.699	10.893	1.206	13.281	1.847	15.603	2.612	17.847	3.492	20.003	4.474															14	20 (H)**

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 8 Degrees

$\Delta = 8°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	214.824	6.213	217.325	6.227	219.826	6.241	222.327	6.257	224.828	6.273	227.329	6.290	229.830	6.308	232.331	6.327	234.833	6.346	237.334	6.367	239.835	6.388	242.337	6.410	244.838	6.433	2500	
2200	193.847	5.495	196.348	5.510	198.849	5.527	201.350	5.544	203.851	5.563	206.353	5.583	208.854	5.603	211.355	5.624	213.857	5.646	216.358	5.670	218.859	5.694	221.361	5.719	223.863	5.745	2200	
2000	179.862	5.018	182.363	5.036	184.865	5.054	187.366	5.073	189.867	5.094	192.368	5.115	194.870	5.137	197.371	5.161	199.873	5.186	202.374	5.211	204.876	5.238	207.378	5.265	209.879	5.294	2000	
1800	165.878	4.545	168.379	4.564	170.880	4.584	173.382	4.606	175.883	4.628	178.385	4.652	180.886	4.677	183.388	4.703	185.889	4.730	188.391	4.759	190.893	4.788	193.395	4.819	195.896	4.851	1800	
1500	144.902	3.842	147.403	3.865	149.905	3.889	152.406	3.915	154.908	3.942	157.409	3.970	159.911	4.000	162.413	4.032	164.915	4.064	167.417	4.099	169.919	4.134	172.421	4.171	174.923	4.209	1500	
1200	123.926	3.154	126.428	3.182	128.930	3.213	131.432	3.245	133.934	3.279	136.436	3.315	138.938	3.352	141.440	3.391	143.942	3.432	146.444	3.475	148.947	3.519	151.449	3.565	153.952	3.613	1200	
1000	109.943	2.710	112.445	2.744	114.947	2.781	117.450	2.819	119.952	2.860	122.454	2.903	124.956	2.948	127.459	2.995	129.962	3.044	132.464	3.095	134.967	3.148	137.470	3.204	139.972	3.261	1000	
900	102.952	2.495	105.454	2.533	107.957	2.574	110.459	2.617	112.961	2.662	115.464	2.710	117.966	2.760	120.469	2.812	122.972	2.866	125.475	2.923	127.978	2.982	130.480	3.044	132.983	3.108	900	
800	95.961	2.288	98.464	2.331	100.966	2.377	103.469	2.425	105.971	2.476	108.474	2.530	110.977	2.585	113.480	2.644	115.983	2.706	118.486	2.770	120.989	2.836	123.492	2.905	125.995	2.977	800	
700	88.971	2.092	91.474	2.141	93.976	2.193	96.479	2.248	98.982	2.306	101.485	2.367	103.988	2.431	106.491	2.499	108.994	2.569	111.497	2.642	114.000	2.718	116.504	2.797	119.007	2.879	700	
600	81.981	1.911	84.484	1.968	86.987	2.029	89.490	2.094	91.993	2.161	94.496	2.233	96.999	2.308	99.503	2.386	102.006	2.468	104.509	2.553	107.013	2.641	109.516	2.734	112.019	2.829	600	
500	74.992	1.756	77.495	1.824	79.998	1.898	82.502	1.975	85.005	2.056	87.508	2.142	90.012	2.231	92.515	2.325	95.018	2.424	97.522	2.526	100.025	2.632	102.529	2.743	105.032	2.857	* 500	
400	68.004	1.645	70.507	1.731	73.011	1.822	75.514	1.919	78.017	2.021	80.521	2.127	83.024	2.240	85.527	2.357	88.031	2.479	90.534	2.607	93.037	2.740	95.539	2.878	98.042	3.021	400	
360	65.209	1.622	67.712	1.717	70.216	1.819	72.719	1.926	75.222	2.039	77.726	2.157	80.229	2.282	82.732	2.412	85.235	2.548	87.737	2.690	90.240	2.838	92.742	2.991	95.244	3.150	360	100 (P)*
350	64.510	1.618	67.014	1.717	69.517	1.821	72.020	1.931	74.524	2.047	77.027	2.169	79.530	2.298	82.033	2.432	84.535	2.571	87.038	2.717	89.540	2.869	92.042	3.027	94.544	3.191	350	
300	61.016	1.623	63.520	1.738	66.023	1.859	68.526	1.988	71.029	2.124	73.531	2.266	76.034	2.415	78.536	2.572	81.038	2.735	83.539	2.905	86.040	3.082	88.541	3.265	91.041	3.456	300	
250	57.522	1.679	60.025	1.816	62.527	1.962	65.030	2.116	67.531	2.279	70.033	2.450	72.534	2.629	75.034	2.816	77.534	3.012	80.033	3.215	82.532	3.427	85.030	3.648	87.527	3.876	250	
230	56.124	1.723	58.626	1.872	61.128	2.031	63.630	2.198	66.131	2.375	68.632	2.560	71.131	2.755	73.631	2.958	76.129	3.170	78.627	3.392	81.124	3.622	83.620	3.861	86.115	4.109	230	80 (P)*
200	54.025	1.823	56.527	1.995	59.027	2.177	61.527	2.369	64.027	2.572	66.525	2.785	69.023	3.009	71.519	3.242	74.015	3.486	76.509	3.740	79.002	4.005	81.494	4.279	83.985	4.564	200	
170	51.923	1.985	54.423	2.186	56.921	2.400	59.418	2.626	61.915	2.865	64.409	3.115	66.903	3.377	69.395	3.651	71.885	3.938	74.374	4.236	76.860	4.546	79.345	4.868	81.828	5.202	170	
155	50.870	2.099	53.368	2.320	55.864	2.555	58.359	2.802	60.853	3.063	63.345	3.337	65.835	3.625	68.323	3.925	70.809	4.238	73.293	4.565	75.775	4.904	78.254	5.257	80.731	5.622	155	65 (P)*
125	48.753	2.436	51.245	2.710	53.735	2.999	56.222	3.305	58.707	3.628	61.189	3.966	63.668	4.321	66.144	4.691	68.616	5.078	71.085	5.480	73.549	5.898	76.010	6.332	78.467	6.782	125	
100	46.966	2.902	49.447	3.243	51.925	3.603	54.399	3.984	56.868	4.384	59.332	4.804	61.792	5.244	64.246	5.703	66.694	6.182	69.137	6.680	71.573	7.198	74.003	7.734	76.426	8.289	100	
90	46.237	3.169	48.711	3.546	51.181	3.946	53.645	4.367	56.104	4.810	58.556	5.275	61.002	5.761	63.442	6.269	65.874	6.798	68.299	7.348	70.717	7.918	73.126	8.510	75.526	9.122	90	50 (P)*
80	45.494	3.507	47.958	3.930	50.415	4.377	52.866	4.849	55.309	5.344	57.745	5.864	60.172	6.407	62.591	6.974	65.001	7.564	67.401	8.178	69.791	8.814	72.171	9.472	74.540	10.153	80	50 (H)**
70	44.727	3.946	47.175	4.426	49.614	4.933	52.045	5.468	54.465	6.030	56.876	6.619	59.275	7.234	61.663	7.875	64.039	8.541	66.402	9.233	68.753	9.950	71.090	10.692	73.413	11.457	70	
60	43.916	4.532	46.339	5.087	48.750	5.673	51.149	6.290	53.534	6.938	55.905	7.615	58.261	8.322	60.601	9.057	62.925	9.820	65.232	10.612	67.521	11.430	69.792	12.275	72.044	13.146	60	40 (P)*
55	43.484	4.904	45.889	5.506	48.279	6.141	50.655	6.808	53.014	7.508	55.357	8.240	57.681	9.002	59.987	9.795	62.274	10.617	64.541	11.468	66.786	12.347	69.010	13.254	71.212	14.187	55	
50	43.023	5.348	45.403	6.004	47.767	6.696	50.112	7.423	52.438	8.184	54.743	8.978	57.026	9.804	59.288	10.662	61.526	11.551	63.740	12.470	65.929	13.418	68.093	14.393	70.229	15.396	50	40 (H)**
45	42.519	5.885	44.867	6.606	47.194	7.365	49.498	8.161	51.778	8.993	54.033	9.860	56.262	10.760	58.463	11.694	60.637	12.658	62.781	13.654	64.895	14.678	66.978	15.730	69.030	16.808	45	35 (P)*
40	41.950	6.547	44.253	7.345	46.528	8.184	48.775	9.061	50.992	9.976	53.178	10.927	55.331	11.913	57.451	12.932	59.536	13.982	61.586	15.062							40	30 (H)**
35	41.276	7.377	43.513	8.268	45.714	9.201	47.880	10.174	50.007	11.186	52.094	12.234															35	
33	40.963	7.769	43.165	8.702	45.327	9.678	47.450	10.695	49.530	11.749																	33	30 (P)*
30	40.425	8.439	42.561	9.441	44.652	10.487																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 9°$

Deviation Angle = 9 Degrees

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	204.254	7.733	206.755	7.736	209.255	7.740	211.755	7.744	214.256	7.750	216.756	7.756	219.257	7.763	221.757	7.771	224.258	7.780	226.759	7.790	229.260	7.800	231.760	7.812	234.261	7.823	2500	
2200	180.644	6.806	183.144	6.810	185.645	6.814	188.145	6.819	190.645	6.825	193.146	6.832	195.647	6.840	198.147	6.850	200.648	6.860	203.149	6.870	205.650	6.882	208.151	6.895	210.652	6.909	2200	
2000	164.904	6.188	167.404	6.192	169.904	6.197	172.405	6.202	174.905	6.209	177.406	6.217	179.907	6.226	182.407	6.236	184.908	6.247	187.409	6.259	189.910	6.272	192.411	6.286	194.912	6.301	2000	
1800	149.163	5.570	151.664	5.574	154.164	5.580	156.665	5.586	159.165	5.594	161.666	5.603	164.167	5.612	166.667	5.623	169.168	5.635	171.669	5.649	174.170	5.664	176.672	5.679	179.173	5.696	1800	
1500	125.553	4.644	128.053	4.649	130.554	4.655	133.054	4.663	135.555	4.672	138.056	4.682	140.557	4.694	143.058	4.707	145.559	4.722	148.060	4.738	150.561	4.756	153.063	4.774	155.564	4.794	1500	
1200	101.943	3.718	104.443	3.724	106.944	3.732	109.444	3.741	111.945	3.753	114.446	3.766	116.947	3.781	119.448	3.797	121.950	3.815	124.451	3.835	126.953	3.857	129.454	3.881	131.956	3.906	1200	
1000	86.202	3.101	88.703	3.108	91.204	3.118	93.705	3.130	96.206	3.143	98.707	3.159	101.208	3.177	103.709	3.196	106.211	3.218	108.713	3.242	111.214	3.268	113.716	3.297	116.218	3.327	1000	
900	78.332	2.793	80.833	2.801	83.334	2.812	85.835	2.824	88.336	2.839	90.837	2.857	93.338	2.877	95.840	2.899	98.342	2.923	100.844	2.950	103.345	2.979	105.848	3.010	108.350	3.044	900	
800	70.462	2.485	72.963	2.494	75.464	2.506	77.965	2.521	80.466	2.537	82.967	2.557	85.469	2.579	87.971	2.604	90.473	2.631	92.975	2.662	95.477	2.694	97.979	2.729	100.482	2.767	800	
700	62.592	2.178	65.093	2.188	67.594	2.201	70.095	2.218	72.597	2.238	75.098	2.260	77.600	2.285	80.102	2.313	82.604	2.345	85.106	2.379	87.609	2.417	90.111	2.457	92.614	2.500	700	100 (P)*
600	54.722	1.871	57.223	1.883	59.724	1.899	62.226	1.918	64.727	1.940	67.229	1.967	69.731	1.996	72.233	2.029	74.736	2.066	77.238	2.106	79.741	2.149	82.244	2.197	84.747	2.247	600	
500	46.852	1.565	49.353	1.579	51.855	1.598	54.356	1.621	56.858	1.648	59.360	1.680	61.863	1.715	64.365	1.755	66.868	1.799	69.371	1.847	71.874	1.899	74.377	1.955	76.881	2.016	500	
400	38.982	1.260	41.484	1.279	43.985	1.302	46.487	1.331	48.990	1.365	51.492	1.404	53.995	1.448	56.498	1.498	59.001	1.553	61.505	1.615	64.008	1.678	66.512	1.749	69.016	1.824	400	
360	35.835	1.139	38.336	1.160	40.838	1.186	43.340	1.218	45.842	1.255	48.345	1.299	50.848	1.348	53.351	1.403	55.855	1.464	58.358	1.531	60.862	1.603	63.366	1.682	65.870	1.766	360	
350	35.048	1.109	37.549	1.130	40.051	1.157	42.553	1.190	45.056	1.228	47.558	1.273	50.061	1.324	52.565	1.381	55.068	1.443	57.572	1.512	60.076	1.587	62.580	1.667	65.084	1.754	350	
300	31.113	0.959	33.615	0.983	36.117	1.015	38.619	1.053	41.122	1.098	43.625	1.150	46.128	1.210	48.632	1.276	51.136	1.349	53.640	1.429	56.144	1.516	58.648	1.610	61.152	1.711	300	80 (P)*
250	27.178	0.811	29.680	0.840	32.183	0.877	34.685	0.923	37.189	0.978	39.692	1.040	42.196	1.111	44.700	1.191	47.204	1.278	49.708	1.374	52.213	1.479	54.717	1.592	57.221	1.713	250	
230	25.604	0.752	28.106	0.784	30.609	0.825	33.112	0.875	35.615	0.934	38.119	1.002	40.623	1.079	43.127	1.165	45.631	1.261	48.136	1.365	50.640	1.478	53.144	1.601	55.648	1.732	230	
200	23.244	0.665	25.746	0.702	28.249	0.749	30.752	0.806	33.256	0.874	35.760	0.953	38.264	1.041	40.768	1.141	43.273	1.250	45.777	1.370	48.281	1.500	50.785	1.641	53.289	1.792	200	
170	20.883	0.581	23.386	0.624	25.889	0.679	28.393	0.747	30.897	0.827	33.401	0.919	35.905	1.023	38.409	1.140	40.914	1.269	43.418	1.410	45.921	1.563	48.424	1.728	50.927	1.906	170	65 (P)*
155	19.703	0.540	22.206	0.587	24.709	0.648	27.213	0.722	29.717	0.809	32.221	0.910	34.726	1.025	37.230	1.153	39.734	1.294	42.237	1.449	44.740	1.617	47.243	1.798	49.744	1.993	155	
125	17.343	0.462	19.846	0.520	22.350	0.595	24.854	0.687	27.358	0.796	29.863	0.921	32.367	1.063	34.870	1.221	37.373	1.396	39.874	1.588	42.375	1.796	44.875	2.020	47.373	2.261	125	
100	15.376	0.403	17.880	0.476	20.384	0.570	22.888	0.685	25.392	0.821	27.896	0.977	30.399	1.154	32.900	1.352	35.400	1.570	37.898	1.809	40.394	2.068	42.888	2.348	45.379	2.648	100	
90	14.590	0.383	17.094	0.464	19.598	0.568	22.102	0.696	24.606	0.846	27.108	1.020	29.610	1.217	32.110	1.436	34.608	1.678	37.103	1.943	39.596	2.231	42.085	2.542	44.571	2.874	90	50 (P)*
80	13.803	0.365	16.307	0.456	18.812	0.574	21.315	0.717	23.818	0.886	26.320	1.081	28.820	1.302	31.317	1.549	33.812	1.821	36.303	2.119	38.790	2.442	41.273	2.790	43.752	3.163	80	50 (H)**
70	13.017	0.351	15.521	0.455	18.025	0.589	20.528	0.753	23.030	0.946	25.530	1.169	28.026	1.421	30.520	1.702	33.009	2.013	35.494	2.352	37.973	2.720	40.447	3.116	42.914	3.541	70	
60	12.230	0.342	14.735	0.464	17.238	0.620	19.740	0.811	22.239	1.036	24.735	1.296	27.227	1.589	29.714	1.916	32.195	2.277	34.669	2.671	37.135	3.098	39.593	3.558	42.042	4.050	60	40 (P)*
55	11.837	0.341	14.341	0.474	16.844	0.644	19.345	0.852	21.842	1.098	24.336	1.380	26.824	1.700	29.305	2.056	31.780	2.448	34.246	2.877	36.703	3.341	39.149	3.840	41.585	4.374	55	
50	11.444	0.343	13.948	0.488	16.450	0.676	18.949	0.904	21.444	1.174	23.933	1.484	26.416	1.835	28.891	2.226	31.356	2.656	33.812	3.125	36.256	3.633	38.687	4.180	41.104	4.763	50	40 (H)**
45	11.051	0.348	13.554	0.510	16.055	0.718	18.552	0.972	21.043	1.271	23.526	1.615	26.002	2.003	28.467	2.436	30.920	2.912	33.361	3.430	35.787	3.991	38.197	4.593	40.590	5.236	45	35 (P)*
40	10.658	0.358	13.160	0.541	15.659	0.774	18.151	1.059	20.637	1.395	23.113	1.781	25.577	2.216	28.028	2.700	30.464	3.232	32.884	3.811	35.284	4.436	37.665	5.106	40.023	5.820	40	35 (H) 30 (P)*
35	10.264	0.376	12.765	0.584	15.260	0.851	17.747	1.176	20.223	1.558	22.687	1.997	25.135	2.491	27.565	3.040	29.976	3.642	32.363	4.296	34.726	5.001	37.063	5.755	39.370	6.557	35	
33	10.107	0.386	12.606	0.607	15.099	0.890	17.583	1.234	20.055	1.638	22.512	2.102	24.951	2.625	27.370	3.204	29.766	3.840	32.137	4.529	34.480	5.272	36.793	6.065	39.074	6.907	33	
30	9.870	0.406	12.368	0.648	14.857	0.958	17.334	1.335	19.797	1.779	22.241	2.287	24.663	2.858	27.060	3.491	29.429	4.183	31.768	4.933	34.073	5.738	36.342	6.597	38.572	7.506	30	30 (H)**
25	9.475	0.452	11.967	0.742	14.445	1.113	16.906	1.563	19.343	2.090	21.754	2.692	24.132	3.366	26.473	4.111	28.775	4.922	31.032	5.796	33.242	6.729	35.401	7.719	37.506	8.761	25	
23	9.316	0.478	11.804	0.793	14.276	1.195	16.726	1.682	19.149	2.252	21.539	2.901	23.890	3.628	26.199	4.427	28.460	5.296	30.670	6.230	32.824	7.224	34.919	8.274			23	25 (P)*
20	9.076	0.530	11.556	0.890	14.014	1.350	16.442	1.905	18.832	2.553	21.179	3.289	23.475	4.107	25.715	5.004	27.893	5.973	30.004	7.008							20	25 (H)**
15	8.667	0.668	11.120	1.143	13.530	1.745	15.884	2.466	18.171	3.298	20.381	4.232	22.503	5.256													15	20 (P)*
14	8.583	0.708	11.026	1.216	13.419	1.857	15.748	2.623	18.000	3.503	20.164	4.486															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 9 Degrees

$\Delta = 9°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	236.762	7.837	239.263	7.850	241.764	7.865	244.265	7.880	246.767	7.897	249.268	7.914	251.769	7.932	254.271	7.951	256.772	7.970	259.273	7.991	261.775	8.012	264.276	8.034	266.778	8.057	2500	
2200	213.153	6.923	215.654	6.939	218.155	6.956	220.656	6.973	223.158	6.992	225.659	7.011	228.161	7.032	230.662	7.053	233.164	7.075	235.665	7.099	238.167	7.123	240.669	7.148	243.171	7.174	2200	
2000	197.413	6.317	199.915	6.335	202.416	6.353	204.917	6.372	207.419	6.393	209.920	6.414	212.422	6.437	214.923	6.460	217.425	6.485	219.927	6.510	222.429	6.537	224.931	6.564	227.433	6.593	2000	
1800	181.674	5.714	184.175	5.733	186.677	5.753	189.178	5.775	191.680	5.797	194.182	5.821	196.683	5.846	199.185	5.872	201.687	5.900	204.189	5.928	206.691	5.958	209.193	5.989	211.695	6.020	1800	
1500	158.066	4.816	160.567	4.839	163.069	4.864	165.571	4.889	168.073	4.917	170.574	4.945	173.076	4.975	175.579	5.006	178.081	5.039	180.583	5.073	183.085	5.109	185.588	5.146	188.090	5.184	1500	
1200	134.458	3.933	136.960	3.962	139.462	3.992	141.964	4.024	144.466	4.058	146.969	4.094	149.471	4.132	151.974	4.171	154.476	4.212	156.979	4.254	159.482	4.299	161.985	4.345	164.488	4.393	1200	
1000	118.721	3.359	121.223	3.394	123.725	3 430	126.228	3.469	128.730	3.510	131.233	3.552	133.736	3.597	136.239	3.645	138.742	3.694	141.245	3.745	143.748	3.798	146.251	3.854	148.755	3.911	1000	
900	110.852	3.080	113.355	3.118	115.857	3.159	118.360	3.202	120.863	3.247	123.366	3.294	125.869	3.344	128.372	3.396	130.875	3.451	133.378	3.508	135.882	3.567	138.385	3.629	140.889	3.693	900	
800	102.984	2.808	105.487	2.851	107.990	2.897	110.493	2.945	112.996	2.996	115.499	3.050	118.002	3.105	120.506	3.164	123.009	3.226	125.513	3.290	128.016	3.356	130.520	3.425	133.024	3.497	800	
700	95.117	2.546	97.620	2.595	100.123	2.648	102.626	2.703	105 130	2.761	107.633	2.822	110.137	2.886	112.640	2.954	115.144	3.024	117.648	3.097	120.152	3.173	122.656	3.252	125.160	3.334	700	
600	87.250	2.301	89.753	2.358	92.257	2.419	94.760	2.484	97.264	2.552	99.768	2.623	102.272	2.698	104.776	2.776	107.280	2.858	109.784	2.943	112.288	3.032	114.792	3.124	117.296	3.220	600	
500	79.384	2.081	81.888	2.150	84.392	2.223	86.896	2.300	89.400	2.382	91.904	2.467	94.408	2.557	96.912	2.651	99.416	2.749	101.921	2.851	104.425	2.958	106.929	3.068	109.434	3.183	500	
400	71.520	1.905	74.024	1.991	76.528	2.083	79.032	2.179	81.537	2.281	84.041	2.388	86.545	2.500	89.049	2.618	91.554	2.740	94.058	2.868	96.562	3.001	99.066	3.139	101.570	3.282	400	
360	68.374	1.856	70.879	1.951	73.383	2.053	75.887	2.160	78.391	2.273	80.896	2.392	83.400	2.517	85.904	2.647	88.408	2.783	90.912	2.925	93.416	3.073	95.919	3.226	98.423	3.385	360	100 (P)*
350	67.588	1.846	70.092	1.944	72.597	2.049	75.101	2.159	77.605	2.275	80.109	2.398	82.614	2.526	85.118	2.660	87.622	2.800	90.125	2.946	92.629	3.098	95.133	3.256	97.636	3.419	350	
300	63.657	1.819	66.161	1.933	68.665	2.055	71.169	2.184	73.673	2.319	76.177	2.462	78.681	2.611	81.185	2.768	83.688	2.931	86.191	3.101	88.693	3.278	91.196	3.462	93.697	3.653	300	
250	59.725	1.842	62.229	1.980	64.733	2.126	67.237	2.280	69.740	2.442	72.243	2.613	74.745	2.792	77.247	2.980	79.749	3.175	82.250	3.379	84.750	3.592	87.250	3.812	89.749	4.041	250	
230	58.152	1.873	60.656	2.022	63.159	2.181	65.662	2.349	68.165	2.525	70.667	2.711	73.169	2.905	75.670	3.109	78.170	3.322	80.670	3.543	83.169	3.773	85.667	4.013	88.164	4.261	230	80 (P)*
200	55.792	1.954	58.295	2.126	60.797	2.308	63.299	2.501	65.800	2.703	68.300	2.917	70.800	3.140	73.298	3.374	75.796	3.618	78.293	3.872	80.788	4.137	83.282	4.412	85.775	4.696	200	
170	53.429	2.096	55.930	2.298	58.430	2.512	60.930	2.738	63.428	2.977	65.925	3.227	68.420	3.489	70.915	3.764	73.408	4.050	75.899	4.349	78.388	4.659	80.876	4.981	83.361	5.315	170	
155	52.245	2.201	54.745	2.422	57.243	2.657	59.741	2.905	62.237	3.166	64.731	3.440	67.224	3.727	69.714	4.028	72.203	4.341	74.690	4.668	77.175	5.008	79.657	5.360	82.137	5.726	155	65 (P)*
125	49.869	2.519	52.363	2.792	54.856	3.082	57.346	3.389	59.833	3.711	62.318	4.050	64.800	4.404	67.279	4.775	69.755	5.162	72.227	5.565	74.695	5.983	77.160	6.417	79.621	6.867	125	
100	47.866	2.969	50.351	3.310	52.832	3.670	55.309	4.051	57.781	4.452	60.249	4.872	62.713	5.312	65.171	5.772	67.624	6.251	70.070	6.749	72.511	7.267	74.946	7.804	77.374	8.359	100	
90	47.053	3.230	49.530	3.607	52.003	4.006	54.471	4.428	56.934	4.871	59.390	5.336	61.841	5.823	64.285	6.331	66.722	6.860	69.151	7.411	71.574	7.982	73.988	8.574	76.394	9.186	90	50 (P)*
80	46.225	3.561	48.693	3.984	51.154	4.432	53.609	4.903	56.056	5.400	58.496	5.920	60.929	6.463	63.352	7.031	65.767	7.621	68.173	8.235	70.568	8.871	72.954	9.530	75.329	10.212	80	50 (H)**
70	45.374	3.993	47.826	4.474	50.270	4.982	52.705	5.517	55.131	6.080	57.546	6.669	59.951	7.284	62.345	7.925	64.727	8.592	67.096	9.285	69.453	10.002	71.796	10.744	74.126	11.510	70	
60	44.481	4.574	46.909	5.129	49.325	5.716	51.729	6.333	54.120	6.981	56.497	7.659	58.859	8.366	61.206	9.102	63.536	9.866	65.850	10.658	68.146	11.477	70.425	12.322	72.684	13.194	60	40 (P)*
55	44.008	4.943	46.418	5.545	48.814	6.180	51.196	6.848	53.561	7.549	55.910	8.281	58.242	9.044	60.555	9.837	62.849	10.659	65.123	11.511	67.376	12.391	69.608	13.298	71.818	14.232	55	
50	43.507	5.384	45.894	6.041	48.263	6.733	50.615	7.460	52.947	8.221	55.259	9.016	57.550	9.843	59.819	10.702	62.065	11.591	64.287	12.510	66.484	13.459	68.656	14.435	70.802	15.438	50	40 (H)**
45	42.964	5.918	45.319	6.640	47.652	7.399	49.963	8.196	52.251	9.028	54.513	9.895	56.750	10.797	58.960	11.730	61.142	12.696	63.295	13.692	65.418	14.716	67.510	15.769	69.571	16.848	45	35 (P)*
40	42.357	6.577	44.667	7.376	46.950	8.215	49.204	9.093	51.430	10.008	53.624	10.960	55.786	11.947	57.915	12.966	60.009	14.017	62.068	15.098							40	30 (H)**
35	41.647	7.404	43.892	8.296	46.101	9.229	48.275	10.204	50.411	11.216	52.508	12.265															35	
33	41.320	7.796	43.530	8.729	45.701	9.706	47.832	10.723	49.922	11.778																	33	30 (P)*
30	40.761	8.464	42.907	9.467	45.007	10.513																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 10°$

Deviation Angle = 10 Degrees

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	226.222	9.552	228.722	9.555	231.222	9.559	233.723	9.564	236.223	9.569	238.724	9.575	241.224	9.583	243.725	9.591	246.226	9.599	248.727	9.609	251.227	9.619	253.728	9.631	256.229	9.643	2500	
2200	199.975	8.407	202.476	8.410	204.976	8.415	207.476	8.420	209.977	8.426	212.477	8.433	214.978	8.441	217.479	8.450	219.980	8.460	222.481	8.471	224.982	8.483	227.483	8.496	229.984	8.510	2200	
2000	182.478	7.644	184.978	7.647	187.478	7.652	189.979	7.658	192.479	7.665	194.980	7.673	197.481	7.681	199.982	7.691	202.483	7.702	204.984	7.714	207.485	7.727	209.986	7.741	212.487	7.757	2000	
1800	164.980	6.880	167.480	6.884	169.981	6.889	172.481	6.896	174.982	6.904	177.483	6.912	179.983	6.922	182.484	6.933	184.985	6.945	187.486	6.958	189.988	6.973	192.489	6.989	194.990	7.006	1800	
1500	138.733	5.736	141.234	5.740	143.734	5.747	146.235	5.754	148.736	5.763	151.237	5.774	153.738	5.786	156.239	5.799	158.740	5.813	161.241	5.830	163.743	5.847	166.244	5.866	168.746	5.886	1500	
1200	112.487	4.591	114.988	4.597	117.488	4.605	119.989	4.615	122.490	4.626	124.991	4.639	127.492	4.654	129.994	4.671	132.495	4.689	134.997	4.709	137.498	4.731	140.000	4.754	142.502	4.779	1200	
1000	94.989	3.829	97.490	3.836	99.991	3.846	102.492	3.857	104.993	3.871	107.494	3.886	109.996	3.904	112.497	3.924	114.999	3.946	117.501	3.970	120.003	3.996	122 505	4.024	125.007	4.055	1000	
900	86.241	3.448	88.741	3.456	91.242	3.467	93.743	3.479	96.244	3.494	98.746	3.512	101.247	3.532	103.749	3.554	106.251	3.578	108 753	3 605	111.255	3.634	113.758	3.665	116.260	3.699	900	
800	77.492	3.067	79.993	3.076	82.494	3.088	84.995	3.103	87.496	3.120	89.998	3.139	92.500	3.161	95.001	3.186	97.504	3.214	100.006	3.244	102.508	3.276	105.011	3.312	107.514	3.350	800	
700	68.743	2.687	71.244	2.698	73.745	2.711	76.246	2.727	78.748	2.747	81.250	2.769	83.752	2.795	86.254	2.823	88.756	2.854	91.259	2.889	93.762	2.926	96.265	2.967	98.768	3.010	700	100 (P)*
600	59.994	2.307	62.495	2.320	64.997	2.335	67.498	2.354	70.000	2.377	72.502	2.403	75.004	2.433	77.507	2.466	80.010	2.502	82.513	2.543	85.016	2.586	87.519	2.633	90.022	2.684	600	
500	51.246	1.929	53.747	1.943	56.249	1.962	58.750	1.985	61.253	2.012	63.755	2.043	66.258	2.079	68.760	2.119	71.264	2.163	73.767	2.211	76.271	2.263	78.774	2.320	81.278	2.380	500	
400	42.497	1.551	44.999	1.570	47.501	1.593	50.003	1.622	52.505	1.656	55.008	1.695	57.512	1.740	60.015	1.789	62.519	1.844	65.023	1.904	67.527	1.969	70.031	2.040	72.536	2.116	400	
360	38.998	1.401	41.500	1.422	44.002	1.448	46.504	1.480	49.007	1.517	51.510	1.561	54.013	1.610	56.517	1.666	59.021	1.727	61.525	1.793	64.030	1.866	66.534	1.944	69.039	2.028	360	
350	38.123	1.364	40.625	1.385	43.127	1.412	45.629	1.444	48.132	1.483	50.635	1.528	53.139	1.579	55.643	1.635	58.147	1.698	60.651	1.767	63.156	1.842	65.660	1.922	68.165	2.009	350	
300	33.749	1.177	36.251	1.202	38.753	1.233	41.256	1.271	43.759	1.317	46.263	1.369	48.767	1.428	51.271	1.494	53.776	1.567	56.280	1.647	58.785	1.735	61.290	1.829	63.795	1.930	300	80 (P)*
250	29.375	0.993	31.877	1.022	34.380	1.059	36.883	1.105	39.387	1.160	41.891	1.222	44.396	1.294	46.900	1.373	49.405	1.461	51.910	1.557	54.415	1.661	56.921	1.774	59.426	1.895	250	
230	27.626	0.919	30.128	0.951	32.631	0.992	35.135	1.042	37.638	1.101	40.143	1.169	42.647	1.247	45.152	1.333	47.657	1.428	50.162	1.533	52.668	1.646	55.173	1.769	57.678	1.900	230	
200	25.001	0.811	27.504	0 848	30.007	0.895	32.511	0.952	35.016	1.020	37.520	1.098	40.025	1.187	42.530	1.286	45.035	1.396	47.541	1.516	50.046	1.647	52.551	1.788	55.056	1.939	200	
170	22.377	0.705	24.880	0.748	27.384	0.803	29.888	0.871	32.393	0.951	34.898	1.043	37.403	1.147	39.909	1.264	42.414	1.393	44.919	1.534	47.424	1.687	49.929	1.853	52.433	2.031	170	65 (P)*
155	21.065	0.653	23.569	0.700	26.073	0.761	28.577	0.835	31.082	0.922	33.587	1.024	36.093	1.138	38.598	1.266	41.103	1 407	43.608	1.562	46.112	1.730	48.616	1.912	51.120	2.107	155	
125	18.442	0.553	20.946	0.611	23.450	0.686	25.955	0.778	28.460	0.887	30.966	1.012	33.471	1.154	35.976	1.313	38.480	1.488	40.983	1.680	43.486	1.888	45.987	2.112	48.487	2.354	125	
100	16.256	0.476	18.760	0.549	21.265	0.643	23.770	0.758	26.276	0.894	28.780	1.050	31.285	1.227	33.788	1.425	36.290	1.644	38.790	1.883	41.288	2.142	43.784	2.422	46.278	2.723	100	
90	15.381	0.448	17.886	0.530	20.391	0.634	22.897	0.762	25.401	0.912	27.906	1.086	30.409	1.283	32.911	1.502	35.411	1.745	37.908	2.010	40.404	2.298	42.896	2.609	45.384	2.942	90	50 (P)*
80	14.507	0.423	17.012	0.515	19.517	0.632	22.022	0.775	24.527	0.945	27.030	1.140	29.532	1.361	32.031	1.608	34.528	1.880	37.022	2.178	39.512	2.502	41.999	2.850	44.480	3.223	80	50 (H)**
70	13.633	0.402	16.138	0.506	18.643	0.640	21.148	0.804	23.651	0.998	26.153	1.221	28.652	1.473	31.148	1.754	33.640	2.063	36.128	2.404	38.610	2.773	41.087	3.169	43.558	3.594	70	
60	12.759	0.386	15.264	0.508	17.769	0.664	20.273	0.855	22.774	1.081	25.272	1.340	27.767	1.634	30.256	1.961	32.740	2.322	35.218	2.716	37.688	3.144	40.150	3.604	42.603	4.096	60	40 (P)*
55	12.322	0.381	14.827	0.514	17.332	0.684	19.834	0.893	22.334	1.138	24.830	1.421	27.320	1.741	29.805	2.097	32.283	2.490	34.753	2.919	37.214	3.383	39.665	3.883	42.105	4.417	55	
50	11.885	0.379	14.390	0.525	16.894	0.713	19.395	0.941	21.892	1.211	24.384	1.522	26.870	1.873	29.348	2.264	31.818	2.694	34.277	3.164	36.725	3.672	39.162	4.219	41.584	4.803	50	40 (H)**
45	11.448	0.381	13.953	0.543	16.455	0.751	18.954	1.005	21.448	1.304	23.935	1.649	26.413	2.037	28.882	2.470	31.340	2.946	33.785	3.465	36.216	4.027	38.631	4.629	41.030	5.272	45	35 (P)*
40	11.011	0.388	13.515	0.570	16.016	0.804	18.511	1.089	20.999	1.425	23.479	1.811	25.947	2.246	28.402	2.731	30.843	3.263	33.267	3.842	35.673	4.468	38.060	5.139	40.424	5.853	40	35 (H) 30 (P)*
35	10.574	0.402	13.076	0.610	15.574	0.877	18.064	1.202	20.544	1.585	23.011	2.024	25.464	2.518	27.899	3.067	30.314	3.670	32.707	4.325	35.077	5.030	37.420	5.785	39.734	6.587	35	
33	10.399	0.411	12.901	0.631	15.396	0.914	17.883	1.258	20.358	1.663	22.819	2.128	25.263	2.650	27.687	3.230	30.089	3.866	32.466	4.557	34.815	5.299	37.135	6.093	39.423	6.936	33	
30	10.136	0.428	12.636	0.670	15.128	0.981	17.609	1.358	20.075	1.802	22.523	2.310	24.950	2.882	27.353	3.515	29.729	4.208	32.074	4.958	34.386	5.764	36.663	6.623	38.901	7.533	30	30 (H)**
25	9.697	0.471	12.192	0.761	14.674	1.132	17.139	1.582	19.581	2 109	21.996	2.712	24.380	3.387	26.728	4.132	29.037	4.943	31.302	5.818	33.520	6.752	35.688	7.743	37.801	8.785	25	
23	9.521	0.495	12.013	0.810	14.488	1.213	16.943	1.700	19.370	2.270	21.765	2.920	24.123	3.647	26.439	4.447	28.708	5.316	30.926	6.251	33.089	7.246	35.193	8.297			23	25 (P)*
20	9.256	0.545	11.739	0.905	14.201	1.365	16.634	1.921	19.030	2.569	21.383	3.305	23.686	4.125	25.934	5.022	28.120	5.992	30.241	7.028							20	25 (H)**
15	8.804	0.679	11.262	1.155	13.677	1.757	16.037	2.479	18.331	3.312	20.549	4.246	22.681	5.271													15	20 (P)*
14	8.712	0.719	11.159	1.227	13.558	1.868	15.894	2.635	18.154	3.516	20.326	4.500															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 10 Degrees

△=10°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	258.730	9.656	261.232	9.669	263.733	9.684	266.234	9.700	268.735	9.716	271.237	9.733	273.738	9.751	276.240	9.770	278.741	9.790	281.243	9.810	283.745	9.832	286.246	9.854	288.748	9.876	2500	
2200	232.485	8.524	234.986	8.540	237.488	8.557	239.989	8.574	242.491	8.593	244.992	8.612	247.494	8.633	249.995	8.654	252.497	8.677	254.999	8.700	257.501	8.724	260.003	8.749	262.505	8.775	2200	
2000	214.988	7.773	217.490	7.790	219.991	7.808	222.493	7.828	224.994	7.848	227.496	7.870	229.998	7.892	232.500	7.915	235.002	7.940	237.504	7.966	240.006	7.992	242.508	8.020	245.010	8.049	2000	
1800	197.492	7.024	199.993	7.043	202.495	7.063	204.997	7.085	207.498	7.107	210.000	7.131	212.502	7.156	215.004	7.182	217.506	7.209	220.009	7.238	222.511	7.268	225.013	7.299	227.516	7.330	1800	
1500	171.247	5.908	173.749	5.931	176.251	5.955	178.753	5.981	181.255	6.008	183.758	6.037	186.260	6.067	188.762	6.098	191.265	6.131	193.767	6.165	196.270	6.200	198.773	6.237	201.275	6.276	1500	
1200	145.004	4.806	147.507	4.835	150.009	4.866	152.511	4.898	155.014	4.932	157.516	4.968	160.019	5.005	162.522	5.044	165.025	5.085	167.528	5.128	170.031	5.172	172.535	5.219	175.038	5.266	1200	
1000	127.510	4.087	130.012	4.122	132.515	4.158	135.018	4.197	137.521	4.238	140.024	4.281	142.527	4.325	145.030	4.373	147.534	4.422	150.037	4.473	152.541	4.526	155.045	4.582	157.549	4.639	1000	
900	118.763	3.735	121.266	3.773	123.769	3.814	126.272	3.857	128.775	3.902	131.278	3.950	133.782	4.000	136.285	4.052	138.789	4.107	141.293	4.163	143.797	4.223	146.301	4.284	148.805	4.348	900	
800	110.017	3.390	112.520	3.433	115.023	3.479	117.526	3.527	120.030	3.578	122.534	3.632	125.037	3.688	127.541	3.747	130.045	3.808	132.549	3.872	135.054	3.939	137.558	4.008	140.062	4.080	800	
700	101.271	3.056	103.774	3.105	106.278	3.158	108.782	3.213	111.286	3.271	113.790	3.332	116.294	3.396	118.798	3.464	121.302	3.534	123.807	3.607	126.311	3.683	128.816	3.762	131.321	3.844	700	
600	92.526	2.738	95.030	2.795	97.534	2.856	100.038	2.921	102.542	2.989	105.047	3.060	107.551	3.135	110.056	3.213	112.561	3.295	115.065	3.381	117.570	3.469	120.075	3.562	122.580	3.657	600	
500	83.782	2.445	86.287	2.514	88.791	2.587	91.296	2.665	93.801	2.746	96.305	2.832	98.810	2.921	101.315	3.015	103.820	3.114	106.326	3.216	108.831	3.323	111.336	3.433	113.841	3.548	500	
400	75.040	2.197	77.545	2.283	80.050	2.374	82.555	2.471	85.060	2.573	87.566	2.680	90.071	2.792	92.576	2.910	95.082	3.032	97.587	3.160	100.092	3.293	102.597	3.431	105.102	3.575	400	
360	71.544	2.118	74.049	2.214	76.554	2.316	79.060	2.423	81.565	2.536	84.070	2.655	86.576	2.780	89.081	2.910	91.586	3.046	94.091	3.188	96.596	3.336	99.101	3.490	101.606	3.649	360	100 (P)*
350	70.670	2.101	73.175	2.200	75.681	2.304	78.186	2.415	80.691	2.531	83.196	2.653	85.702	2.781	88.207	2.916	90.712	3.056	93.217	3.202	95.722	3.354	98.227	3.512	100.732	3.676	350	
300	66.301	2.038	68.806	2.152	71.311	2.274	73.816	2.403	76.322	2.539	78.827	2.681	81.332	2.831	83.837	2.987	86.341	3.151	88.846	3.321	91.350	3.498	93.854	3.682	96.357	3.873	300	
250	61.931	2.025	64.436	2.162	66.942	2.308	69.446	2.463	71.951	2.626	74.456	2.796	76.960	2.976	79.463	3.163	81.967	3.359	84.469	3.563	86.972	3.775	89.474	3.996	91.975	4.225	250	
230	60.183	2.041	62.688	2.191	65.193	2.349	67.698	2.517	70.202	2.694	72.706	2.880	75.209	3.074	77.712	3.278	80.214	3.491	82.716	3.712	85.217	3.943	87.717	4.183	90.216	4.431	230	80 (P)*
200	57.561	2.100	60.065	2.272	62.569	2.455	65.073	2.647	67.576	2.851	70.078	3.064	72.579	3.288	75.080	3.521	77.580	3.766	80.079	4.020	82.576	4.285	85.073	4.560	87.569	4.845	200	
170	54.936	2.221	57.439	2.423	59.941	2.637	62.443	2.864	64.943	3.102	67.442	3.353	69.940	3.615	72.437	3.890	74.932	4.176	77.426	4.475	79.918	4.786	82.408	5.108	84.897	5.442	170	
155	53.622	2.315	56.124	2.536	58.625	2.771	61.124	3.019	63.622	3.280	66.119	3.555	68.614	3.842	71.107	4.143	73.599	4.457	76.089	4.784	78.577	5.124	81.062	5.477	83.545	5.843	155	65 (P)*
125	50.986	2.611	53.483	2.885	55.977	3.175	58.470	3.482	60.961	3.804	63.448	4.143	65.933	4.498	68.416	4.869	70.895	5.256	73.370	5.659	75.843	6.078	78.311	6.513	80.776	6.963	125	
100	48.768	3.044	51.256	3.384	53.740	3.745	56.220	4.126	58.696	4.527	61.168	4.948	63.635	5.389	66.097	5.849	68.554	6.328	71.006	6.827	73.451	7.245	75.890	7.882	78.323	8.438	100	
90	47.869	3.297	50.350	3.675	52.827	4.075	55.298	4.496	57.765	4.940	60.225	5.406	62.680	5.893	65.128	6.401	67.570	6.931	70.005	7.481	72.432	8.053	74.851	8.645	77.263	9.258	90	50 (P)*
80	46.957	3.622	49.428	4.045	51.894	4.493	54.352	4.965	56.804	5.461	59.249	5.982	61.686	6.526	64.115	7.093	66.535	7.685	68.946	8.299	71.347	8.936	73.738	9.595	76.119	10.277	80	50 (H)**
70	46.022	4.047	48.479	4.528	50.927	5.036	53.367	5.572	55.797	6.135	58.218	6.724	60.628	7.340	63.027	7.982	65.415	8.649	67.791	9.342	70.154	10.060	72.503	10.802	74.840	11.569	70	
60	45.047	4.620	47.480	5.176	49.901	5.764	52.310	6.382	54.707	7.030	57.089	7.708	59.458	8.415	61.811	9.152	64.148	9.916	66.469	10.709	68.773	11.528	71.058	12.375	73.325	13.247	60	40 (P)*
55	44.533	4.986	46.949	5.589	49.350	6.225	51.738	6.893	54.109	7.594	56.464	8.327	58.803	9.090	61.123	9.884	63.424	10.707	65.705	11.559	67.966	12.440	70.206	13.347	72.424	14.282	55	
50	43.992	5.424	46.385	6.081	48.760	6.774	51.118	7.502	53.457	8.264	55.776	9.059	58.074	9.886	60.351	10.746	62.604	11.636	64.835	12.556	67.040	13.505	69.221	14.482	71.375	15.485	50	40 (H)**
45	43.410	5.955	45.771	6.677	48.111	7.437	50.429	8.234	52.724	9.067	54.994	9.935	57.239	10.837	59.457	11.772	61.647	12.738	63.809	13.734	65.941	14.760	68.042	15.813	70.113	16.893	45	35 (P)*
40	42.766	6.611	45.082	7.410	47.372	8.250	49.634	9.128	51.868	10.045	54.070	10.997	56.241	11.984	58.379	13.004	60.482	14.056	62.550	15.138							40	30 (H)**
35	42.019	7.435	44.271	8.327	46.489	9.262	48.671	10.236	50.816	11.250	52.922	12.299															35	
33	41.677	7.825	43.895	8.760	46.075	9.737	48.215	10.755	50.314	11.810																	33	30 (P)*
30	41.098	8.492	43.252	9.496	45.362	10.542																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 11 Degrees

Δ=11°

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	248.223	11.567	250.723	11.570	253.223	11.574	255.724	11.578	258.224	11.584	260.725	11.590	263.226	11.597	265.726	11.605	268.227	11.614	270.728	11.624	273.229	11.634	275.730	11.646	278.231	11.657	2500	
2200	219.336	10.180	221.836	10.183	224.337	10.188	226.837	10.193	229.338	10.199	231.839	10.206	234.339	10.214	236.840	10.223	239.341	10.233	241.842	10.244	244.343	10.256	246.844	10.269	249.346	10.283	2200	
2000	200.078	9.255	202.579	9.259	205.079	9.264	207.580	9.270	210.080	9.276	212.581	9.284	215.082	9.293	217.583	9.303	220.084	9.314	222.585	9.326	225.086	9.339	227.587	9.353	230.089	9.368	2000	
1800	180.821	8.331	183.321	8.335	185.822	8.340	188.322	8.346	190.823	8.354	193.324	8.363	195.825	8.373	198.326	8.384	200.827	8.396	203.328	8.409	205.829	8.424	208.331	8.440	210.832	8.456	1800	
1500	151.934	6.944	154.435	6.949	156.935	6.955	159.436	6.963	161.937	6.972	164.438	6.983	166.939	6.994	169.440	7.008	171.941	7.022	174.443	7.039	176.944	7.056	179.446	7.075	181.948	7.095	1500	
1200	123.048	5.558	125.548	5.564	128.049	5.572	130.550	5.582	133.051	5.593	135.552	5.606	138.053	5.621	140.555	5.638	143.056	5.656	145.558	5.676	148.060	5.698	150.562	5.721	153.064	5.747	1200	
1000	103.790	4.635	106.291	4.642	108.791	4.652	111.292	4.663	113.794	4.677	116.295	4.692	118.797	4.710	121.298	4.730	123.800	4.752	126.303	4.776	128.805	4.802	131.307	4.830	133.810	4.861	1000	
900	94.161	4.173	96.662	4.181	99.163	4.192	101.664	4.205	104.165	4.220	106.667	4.237	109.169	4.257	111.671	4.279	114.173	4.303	116.675	4.330	119.177	4.359	121.680	4.391	124.183	4.425	900	
800	84.532	3.712	87.033	3.721	89.534	3.733	92.036	3.747	94.537	3.764	97.039	3.784	99.541	3.806	102.043	3.831	104.545	3.858	107.048	3.889	109.551	3.921	112.054	3.957	114.557	3.995	800	
700	74.904	3.251	77.405	3.262	79.906	3.275	82.407	3.292	84.909	3.311	87.411	3.333	89.913	3.359	92.416	3.387	94.918	3.418	97.421	3.453	99.924	3.490	102.427	3.531	104.931	3.574	700	100 (P)*
600	65.275	2.791	67.776	2.803	70.277	2.819	72.779	2.838	75.281	2.861	77.783	2.887	80.286	2.917	82.789	2.949	85.292	2.986	87.795	3.026	90.298	3.070	92.802	3.117	95.306	3.168	600	
500	55.646	2.332	58.148	2.346	60.649	2.365	63.151	2.388	65.654	2.415	68.156	2.447	70.659	2.482	73.162	2.522	75.666	2.566	78.170	2.614	80.674	2.666	83.178	2.723	85.683	2.784	500	
400	46.018	1.874	48.519	1.892	51.021	1.916	53.524	1.944	56.027	1.979	58.530	2.018	61.034	2.062	63.537	2.112	66.042	2.167	68.546	2.227	71.051	2.292	73.556	2.363	76.061	2.438	400	
360	42.166	1.691	44.668	1.712	47.170	1.738	49.673	1.770	52.176	1.808	54.680	1.851	57.184	1.901	59.688	1.956	62.192	2.017	64.697	2.083	67.202	2.156	69.708	2.235	72.213	2.319	360	
350	41.204	1.646	43.705	1.667	46.208	1.694	48.711	1.727	51.214	1.765	53.717	1.810	56.221	1.861	58.726	1.918	61.230	1.981	63.735	2.049	66.240	2.124	68.746	2.205	71.251	2.292	350	
300	36.390	1.419	38.892	1.444	41.394	1.475	43.897	1.513	46.401	1.559	48.905	1.611	51.410	1.670	53.914	1.736	56.419	1.810	58.925	1.890	61.430	1.977	63.936	2.071	66.442	2.172	300	80 (P)*
250	31.576	1.194	34.078	1.223	36.581	1.261	39.085	1.307	41.589	1.361	44.094	1.424	46.599	1.495	49.104	1.575	51.610	1.663	54.116	1.759	56.622	1.863	59.128	1.976	61.634	2.097	250	
230	29.650	1.105	32.153	1.137	34.656	1.178	37.160	1.228	39.664	1.287	42.169	1.355	44.675	1.432	47.180	1.519	49.686	1.614	52.192	1.719	54.698	1.832	57.205	1.955	59.711	2.087	230	
200	26.762	0.972	29.265	1.009	31.769	1.056	34.273	1.113	36.778	1.181	39.283	1.260	41.789	1.349	44.295	1.448	46.801	1.558	49.307	1.678	51.814	1.809	54.320	1.949	56.827	2.101	200	
170	23.874	0.842	26.377	0.885	28.882	0.940	31.386	1.008	33.892	1.088	36.398	1.180	38.904	1.285	41.410	1.401	43.916	1.530	46.423	1.672	48.929	1.825	51.435	1.991	53.941	2.169	170	65 (P)*
155	22.430	0.778	24.934	0.825	27.438	0.886	29.943	0.960	32.449	1.048	34.955	1.149	37.461	1.263	39.968	1.391	42.474	1.533	44.980	1.688	47.486	1.856	49.992	2.038	52.497	2.233	155	
125	19.542	0.654	22.047	0.712	24.552	0.787	27.058	0.879	29.564	0.988	32.070	1.113	34.577	1.256	37.083	1.414	39.589	1.589	42.094	1.781	44.598	1.990	47.102	2.214	49.604	2.456	125	
100	17.137	0.557	19.642	0.630	22.147	0.724	24.654	0.839	27.160	0.975	29.666	1.131	32.172	1.309	34.677	1.507	37.181	1.725	39.683	1.965	42.184	2.224	44.682	2.505	47.178	2.805	100	
90	16.174	0.521	18.680	0.602	21.186	0.707	23.692	0.834	26.199	0.985	28.704	1.159	31.209	1.356	33.713	1.576	36.215	1.819	38.715	2.084	41.213	2.372	43.708	2.683	46.199	3.016	90	30 (P)*
80	15.212	0.488	17.718	0.579	20.224	0.697	22.731	0.840	25.237	1.010	27.742	1.205	30.245	1.427	32.747	1.674	35.246	1.946	37.743	2.244	40.236	2.568	42.725	2.916	45.210	3.290	80	50 (H)**
70	14.250	0.458	16.756	0.563	19.263	0.697	21.769	0.861	24.274	1.055	26.777	1.278	29.279	1.530	31.777	1.812	34.272	2.121	36.762	2.462	39.248	2.831	41.729	3.228	44.203	3.653	70	
60	13.288	0.434	15.795	0.536	18.301	0.713	20.806	0.904	23.310	1.130	25.810	1.389	28.307	1.683	30.799	2.011	33.287	2.372	35.768	2.767	38.242	3.194	40.708	3.655	43.165	4.148	60	40 (P)*
55	12.808	0.426	15.314	0.538	17.820	0.729	20.324	0.938	22.826	1.183	25.324	1.466	27.818	1.786	30.306	2.143	32.787	2.536	35.261	2.965	37.726	3.430	40.181	3.930	42.626	4.465	55	
50	12.327	0.419	14.833	0.566	17.338	0.753	19.842	0.982	22.341	1.252	24.836	1.563	27.325	1.914	29.806	2.306	32.280	2.737	34.743	3.207	37.196	3.715	39.637	4.262	42.065	4.847	50	40 (H)**
45	11.846	0.417	14.352	0.580	16.856	0.788	19.358	1.042	21.854	1.342	24.344	1.686	26.826	2.075	29.298	2.508	31.760	2.985	34.210	3.504	36.646	4.066	39.067	4.669	41.471	5.313	45	35 (P)*
40	11.365	0.420	13.871	0.603	16.373	0.837	18.871	1.122	21.363	1.458	23.845	1.845	26.317	2.290	28.777	2.765	31.222	3.298	33.652	3.878	36.083	4.504	38.455	5.175	40.826	5.890	40	35 (H) 30 (P)*
35	10.884	0.431	13.389	0.639	15.888	0.906	18.381	1.231	20.864	1.614	23.336	2.053	25.792	2.548	28.232	3.098	30.653	3.701	33.052	4.356	35.428	5.062	37.777	5.817	40.099	6.620	35	
33	10.692	0.438	13.195	0.658	15.694	0.941	18.183	1.286	20.662	1.691	23.127	2.156	25.575	2.679	28.005	3.260	30.412	3.896	32.795	4.587	35.151	5.330	37.478	6.124	39.773	6.968	33	
30	10.403	0.452	12.905	0.695	15.400	1.005	17.884	1.383	20.354	1.827	22.807	2.336	25.239	2.908	27.647	3.542	30.029	4.235	32.381	4.986	34.700	5.793	36.984	6.653	39.230	7.564	30	30 (H)**
25	9.921	0.491	12.418	0.782	14.903	1.153	17.372	1.603	19.818	2.131	22.239	2.734	24.629	3.410	26.984	4.155	29.303	4.967	31.572	5.843	33.798	6.778	35.975	7.769	38.098	8.812	25	
23	9.727	0.514	12.221	0.829	14.700	1.232	17.159	1.720	19.592	2.290	21.993	2.941	24.357	3.668	26.680	4.469	28.957	5.339	31.183	6.274	33.354	7.270	35.468	8.322			23	25 (P)*
20	9.436	0.561	11.923	0.922	14.388	1.383	16.826	1.939	19.228	2.587	21.587	3.324	23.898	4.144	26.153	5.042	28.348	6.013	30.478	7.050							20	25 (H)**
15	8.942	0.692	11.403	1.168	13.824	1.771	16.190	2.493	18.492	3.326	20.718	4.261															15	20 (P)*
14	8.841	0.731	11.293	1.239	13.697	1.881	16.040	2.648	18.307	3.530	20.489	4.515															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 11 Degrees

$\Delta = 11°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	280.732	11.670	283.234	11.684	285.735	11.699	288.236	11.714	290.738	11.731	293.239	11.748	295.741	11.766	298.243	11.785	300.744	11.804	303.246	11.825	305.748	11.846	308.250	11.868	310.752	11.891	2500	
2200	251.847	10.297	254.348	10.313	256.850	10.330	259.352	10.347	261.853	10.366	264.355	10.385	266.857	10.406	269.359	10.427	271.861	10.450	274.363	10.473	276.865	10.497	279.367	10.522	281.869	10.549	2200	
2000	232.590	9.385	235.092	9.402	237.593	9.420	240.095	9.439	242.597	9.460	245.099	9.481	247.601	9.504	250.103	9.527	252.605	9.552	255.107	9.578	257.610	9.604	260.112	9.632	262.615	9.661	2000	
1800	213.334	8.474	215.835	8.494	218.337	8.514	220.839	8.536	223.341	8.558	225.843	8.582	228.345	8.607	230.848	8.633	233.350	8.660	235.852	8.689	238.355	8.719	240.858	8.750	243.360	8.781	1800	
1500	184.450	7.116	186.952	7.140	189.454	7.164	191.956	7.190	194.458	7.217	196.961	7.246	199.463	7.276	201.966	7.307	204.469	7.340	206.972	7.374	209.475	7.410	211.978	7.447	214.481	7.485	1500	
1200	155.567	5.774	158.069	5.802	160.572	5.833	163.074	5.865	165.577	5.899	168.080	5.935	170.583	5.972	173.087	6.012	175.590	6.053	178.093	6.095	180.597	6.140	183.101	6.186	185.604	6.234	1200	
1000	136.313	4.893	138.815	4.928	141.318	4.964	143.822	5.003	146.325	5.044	148.828	5.087	151.332	5.132	153.836	5.179	156.340	5.228	158.844	5.279	161.348	5.333	163.852	5.388	166.356	5.446	1000	
900	126.686	4.460	129.189	4.499	131.692	4.540	134.196	4.583	136.700	4.628	139.203	4.675	141.707	4.725	144.211	4.778	146.715	4.832	149.220	4.889	151.724	4.949	154.229	5.010	156.733	5.074	900	
800	117.060	4.035	119.563	4.078	122.067	4.124	124.571	4.172	127.075	4.223	129.579	4.277	132.083	4.333	134.588	4.392	137.092	4.453	139.597	4.518	142.102	4.584	144.607	4.654	147.112	4.726	800	
700	107.435	3.620	109.938	3.670	112.443	3.722	114.947	3.777	117.451	3.836	119.956	3.897	122.460	3.961	124.965	4.029	127.470	4.099	129.975	4.172	132.480	4.248	134.986	4.327	137.491	4.409	700	
600	97.810	3.222	100.315	3.279	102.819	3.340	105.324	3.405	107.829	3.473	110.334	3.544	112.839	3.619	115.344	3.698	117.850	3.780	120.355	3.865	122.861	3.954	125.367	4.046	127.873	4.142	600	
500	88.187	2.848	90.692	2.917	93.197	2.990	95.703	3.068	98.208	3.149	100.714	3.235	103.219	3.325	105.725	3.419	108.231	3.518	110.737	3.620	113.243	3.727	115.750	3.837	118.256	3.952	500	
400	78.566	2.520	81.072	2.606	83.578	2.697	86.084	2.794	88.590	2.896	91.096	3.003	93.602	3.115	96.109	3.233	98.615	3.356	101.121	3.484	103.628	3.617	106.134	3.755	108.641	3.899	400	
360	74.719	2.409	77.225	2.505	79.731	2.606	82.237	2.714	84.743	2.827	87.250	2.946	89.756	3.071	92.262	3.201	94.769	3.338	97.275	3.480	99.782	3.628	102.288	3.781	104.794	3.941	360	100 (P)*
350	73.757	2.384	76.263	2.482	78.769	2.587	81.275	2.698	83.782	2.814	86.288	2.937	88.794	3.065	91.301	3.199	93.807	3.339	96.314	3.485	98.820	3.638	101.326	3.796	103.832	3.960	350	
300	68.949	2.280	71.455	2.395	73.961	2.517	76.468	2.646	78.974	2.781	81.480	2.924	83.987	3.074	86.493	3.230	88.999	3.394	91.505	3.564	94.011	3.742	96.516	3.926	99.021	4.117	300	
250	64.141	2.227	66.647	2.365	69.154	2.511	71.660	2.666	74.166	2.828	76.672	2.999	79.177	3.179	81.683	3.367	84.188	3.562	86.692	3.767	89.197	3.979	91.700	4.200	94.203	4.429	250	
230	62.218	2.227	64.724	2.377	67.230	2.536	69.736	2.704	72.242	2.881	74.747	3.067	77.252	3.262	79.757	3.465	82.261	3.678	84.765	3.900	87.268	4.131	89.770	4.371	92.272	4.619	230	80 (P)*
200	59.333	2.263	61.839	2.435	64.344	2.617	66.849	2.810	69.354	3.013	71.858	3.227	74.362	3.451	76.864	3.685	79.366	3.929	81.867	4.184	84.367	4.449	86.866	4.724	89.364	5.009	200	
170	56.446	2.359	58.951	2.561	61.455	2.776	63.958	3.002	66.461	3.241	68.962	3.492	71.462	3.755	73.961	4.029	76.459	4.316	78.956	4.615	81.450	4.926	83.944	5.249	86.435	5.583	170	
155	55.000	2.441	57.505	2.663	60.008	2.898	62.509	3.146	65.010	3.408	67.509	3.682	70.007	3.970	72.503	4.271	74.997	4.585	77.490	4.912	79.980	5.252	82.469	5.606	84.955	5.972	155	65 (P)*
125	52.105	2.714	54.604	2.988	57.101	3.278	59.597	3.585	62.090	3.908	64.581	4.247	67.069	4.602	69.554	4.974	72.037	5.361	74.516	5.764	76.992	6.183	79.464	6.618	81.933	7.069	125	
100	49.672	3.126	52.162	3.467	54.649	3.829	57.133	4.210	59.613	4.611	62.088	5.032	64.559	5.473	67.025	5.934	69.486	6.413	71.942	6.913	74.392	7.431	76.836	7.968	79.274	8.525	100	
90	48.687	3.372	51.172	3.760	53.651	4.150	56.127	4.572	58.597	5.016	61.062	5.482	63.521	5.970	65.974	6.478	68.420	7.008	70.859	7.560	73.292	8.132	75.716	8.725	78.133	9.338	90	50 (P)*
80	47.690	3.689	50.105	4.113	52.634	4.561	55.097	5.033	57.554	5.530	60.003	6.051	62.445	6.595	64.878	7.164	67.303	7.755	69.720	8.370	72.127	9.007	74.524	9.667	76.911	10.350	80	50 (H)**
70	46.671	4.107	49.132	4.588	51.585	5.097	54.029	5.633	56.465	6.196	58.890	6.786	61.306	7.402	63.711	8.044	66.104	8.712	68.486	9.406	70.855	10.124	73.212	10.867	75.555	11.635	70	
60	45.611	4.672	48.051	5.229	50.478	5.816	52.892	6.435	55.294	7.084	57.683	7.762	60.058	8.470	62.417	9.207	64.761	9.972	67.089	10.766	69.400	11.586	71.693	12.433	73.967	13.306	60	40 (P)*
55	45.039	5.034	47.580	5.637	49.887	6.274	52.280	6.943	54.658	7.644	57.020	8.377	59.364	9.141	61.691	9.936	64.000	10.760	66.289	11.613	68.558	12.494	70.805	13.402	73.032	14.338	55	
50	44.478	5.468	46.876	6.126	49.258	6.820	51.622	7.548	53.968	8.310	56.294	9.106	58.599	9.935	60.883	10.795	63.145	11.685	65.383	12.606	67.597	13.556	69.786	14.533	71.949	15.538	50	40 (H)**
45	43.857	5.986	46.224	6.719	48.571	7.479	50.896	8.277	53.198	9.111	55.476	9.979	57.728	10.882	59.954	11.817	62.153	12.784	64.324	13.781	66.465	14.808	68.576	15.862	70.655	16.943	45	35 (P)*
40	43.174	6.648	45.498	7.448	47.795	8.289	50.065	9.168	52.306	10.085	54.517	11.038	56.697	12.026	58.843	13.047	60.956	14.100	63.034	15.182							40	30 (H)**
35	42.391	7.469	44.651	8.362	46.877	9.297	49.068	10.273	51.221	11.287	53.337	12.337															35	
33	42.035	7.858	44.261	8.793	46.450	9.771	48.599	10.790	50.707	11.846																	33	30 (P)*
30	41.431	8.523	43.599	9.527	45.717	10.575																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Δ=12°

Deviation Angle = 12 Degrees

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	270.261	13.775	272.761	13.778	275.261	13.781	277.762	13.786	280.262	13.792	282.763	13.798	285.264	13.805	287.765	13.813	290.266	13.822	292.766	13.832	295.268	13.842	297.769	13.853	300.270	13.865	2500	
2200	238.730	12.123	241.230	12.126	243.730	12.130	246.231	12.136	248.732	12.142	251.232	12.149	253.733	12.157	256.234	12.165	258.735	12.176	261.236	12.187	263.737	12.199	266.239	12.212	268.740	12.226	2200	
2000	217.709	11.021	220.209	11.025	222.710	11.030	225.210	11.036	227.711	11.043	230.212	11.051	232.713	11.059	235.214	11.069	237.715	11.080	240.216	11.092	242.717	11.105	245.219	11.119	247.720	11.133	2000	
1800	196.688	9.920	199.188	9.925	201.689	9.930	204.190	9.936	206.690	9.944	209.191	9.952	211.692	9.962	214.193	9.973	216.695	9.986	219.196	9.999	221.697	10.014	224.199	10.029	226.701	10.046	1800	
1500	165.157	8.269	167.657	8.274	170.158	8.280	172.659	8.288	175.160	8.297	177.661	8.307	180.162	8.319	182.663	8.332	185.165	8.347	187.666	8.363	190.168	8.381	192.670	8.400	195.172	8.420	1500	
1200	133.626	6.618	136.126	6.624	138.627	6.632	141.128	6.642	143.629	6.653	146.131	6.666	148.632	6.681	151.134	6.698	153.636	6.716	156.137	6.736	158.640	6.758	161.142	6.781	163.644	6.806	1200	
1000	112.605	5.518	115.106	5.525	117.607	5.535	120.108	5.546	122.609	5.560	125.111	5.575	127.613	5.593	130.115	5.613	132.617	5.635	135.119	5.659	137.622	5.685	140.124	5.714	142.627	5.744	1000	
900	102.095	4.968	104.596	4.976	107.097	4.987	109.598	5.000	112.099	5.015	114.601	5.032	117.103	5.052	119.605	5.074	122.108	5.098	124.610	5.125	127.113	5.154	129.616	5.186	132.119	5.219	900	
800	91.585	4.418	94.085	4.427	96.587	4.439	99.088	4.454	101.590	4.471	104.092	4.490	106.594	4.513	109.096	4.538	111.599	4.565	114.102	4.595	116.605	4.628	119.108	4.663	121.611	4.701	800	
700	81.074	3.869	83.575	3.880	86.077	3.893	88.578	3.910	91.080	3.929	93.582	3.952	96.085	3.977	98.587	4.005	101.090	4.037	103.594	4.072	106.097	4.109	108.601	4.149	111.104	4.192	700	100 (P)*
600	70.564	3.321	73.065	3.333	75.567	3.349	78.069	3.368	80.571	3.390	83.073	3.417	85.576	3.447	88.079	3.479	90.583	3.516	93.086	3.556	95.590	3.600	98.094	3.647	100.599	3.698	600	
500	60.054	2.773	62.555	2.788	65.057	2.806	67.560	2.830	70.062	2.857	72.565	2.888	75.068	2.924	77.572	2.964	80.076	3.008	82.580	3.056	85.085	3.108	87.589	3.165	90.094	3.226	500	
400	49.544	2.227	52.046	2.245	54.548	2.269	57.051	2.298	59.554	2.332	62.058	2.371	64.561	2.416	67.066	2.465	69.570	2.520	72.075	2.580	74.581	2.646	77.086	2.717	79.592	2.792	400	
360	45.340	2.009	47.842	2.030	50.345	2.056	52.848	2.088	55.351	2.125	57.855	2.169	60.359	2.219	62.864	2.274	65.369	2.335	67.874	2.402	70.380	2.475	72.886	2.553	75.392	2.637	360	
350	44.289	1.955	46.791	1.976	49.294	2.003	51.797	2.036	54.300	2.074	56.804	2.119	59.309	2.170	61.813	2.227	64.319	2.290	66.824	2.359	69.330	2.434	71.836	2.514	74.342	2.601	350	
300	39.034	1.684	41.537	1.708	44.040	1.740	46.543	1.778	49.047	1.824	51.552	1.876	54.057	1.935	56.562	2.002	59.068	2.075	61.574	2.155	64.080	2.242	66.587	2.336	69.094	2.437	300	80 (P)*
250	33.780	1.415	36.283	1.444	38.786	1.482	41.290	1.528	43.795	1.582	46.300	1.645	48.805	1.716	51.311	1.796	53.818	1.884	56.325	1.980	58.832	2.085	61.339	2.198	63.846	2.319	250	
230	31.678	1.308	34.181	1.340	36.685	1.381	39.189	1.431	41.694	1.490	44.199	1.558	46.705	1.636	49.212	1.722	51.718	1.818	54.225	1.922	56.733	2.036	59.240	2.159	61.748	2.291	230	
200	28.525	1.149	31.029	1.185	33.533	1.233	36.038	1.290	38.543	1.358	41.049	1.437	43.556	1.526	46.063	1.625	48.570	1.735	51.077	1.855	53.585	1.986	56.092	2.127	58.600	2.279	200	
170	25.373	0.992	27.877	1.035	30.382	1.090	32.887	1.158	35.393	1.238	37.900	1.331	40.407	1.435	42.914	1.552	45.422	1.681	47.929	1.823	50.437	1.976	52.944	2.142	55.452	2.320	170	65 (P)*
155	23.797	0.915	26.301	0.962	28.806	1.022	31.312	1.097	33.818	1.185	36.325	1.286	38.833	1.401	41.340	1.529	43.848	1.671	46.355	1.826	48.863	1.994	51.370	2.176	53.877	2.371	155	
125	20.645	0.764	23.150	0.823	25.656	0.898	28.162	0.998	30.669	1.099	33.177	1.224	35.685	1.366	38.192	1.525	40.700	1.701	43.206	1.893	45.713	2.101	48.218	2.326	50.722	2.568	125	
100	18.019	0.645	20.525	0.718	23.031	0.813	25.539	0.928	28.046	1.064	30.554	1.220	33.061	1.398	35.568	1.596	38.073	1.815	40.578	2.054	43.081	2.314	45.582	2.595	48.080	2.896	100	
90	16.969	0.600	19.475	0.682	21.982	0.786	24.489	0.914	26.997	1.065	29.504	1.239	32.011	1.436	34.517	1.656	37.021	1.899	39.523	2.165	42.023	2.453	44.521	2.764	47.015	3.098	90	50 (P)*
80	15.918	0.558	18.425	0.650	20.932	0.768	23.440	0.911	25.947	1.081	28.454	1.277	30.960	1.498	33.464	1.745	35.965	2.018	38.464	2.317	40.960	2.640	43.453	2.989	45.941	3.363	80	50 (H)**
70	14.868	0.520	17.376	0.625	19.883	0.759	22.391	0.923	24.897	1.117	27.403	1.340	29.906	1.593	32.407	1.875	34.905	2.186	37.398	2.526	39.887	2.895	42.371	3.292	44.850	3.718	70	
60	13.819	0.488	16.326	0.610	18.834	0.766	21.341	0.958	23.846	1.183	26.349	1.443	28.848	1.737	31.344	2.065	33.834	2.427	36.318	2.822	38.796	3.250	41.266	3.711	43.728	4.204	60	40 (P)*
55	13.294	0.474	15.802	0.607	18.309	0.778	20.815	0.987	23.319	1.233	25.820	1.516	28.316	1.836	30.807	2.193	33.292	2.587	35.769	3.016	38.238	3.482	40.698	3.982	43.148	4.517	55	
50	12.769	0.464	15.277	0.610	17.784	0.798	20.289	1.027	22.791	1.297	25.288	1.608	27.780	1.960	30.265	2.352	32.742	2.783	35.210	3.253	37.667	3.763	40.113	4.310	42.546	4.893	50	40 (H)**
45	12.245	0.457	14.752	0.620	17.258	0.828	19.762	1.082	22.260	1.382	24.753	1.727	27.239	2.116	29.715	2.550	32.181	3.027	34.636	3.547	37.076	4.109	39.502	4.713	41.912	5.357	45	35 (P)*
40	11.720	0.456	14.227	0.638	16.732	0.873	19.232	1.158	21.726	1.495	24.212	1.881	26.688	2.318	29.152	2.803	31.602	3.336	34.037	3.916	36.454	4.543	38.852	5.215	41.229	5.930	40	35 (H) 30 (P)*
35	11.195	0.462	13.701	0.670	16.204	0.938	18.699	1.265	21.186	1.646	23.661	2.086	26.122	2.581	28.567	3.131	30.993	3.735	33.398	4.391	35.779	5.097	38.136	5.853	40.464	6.657	35	
33	10.985	0.467	13.491	0.688	15.991	0.971	18.484	1.316	20.967	1.721	23.436	2.187	25.889	2.710	28.323	3.291	30.736	3.928	33.125	4.620	35.487	5.364	37.821	6.159	40.124	7.003	33	
30	10.670	0.479	13.174	0.722	15.672	1.033	18.159	1.411	20.633	1.855	23.090	2.365	25.528	2.937	27.941	3.571	30.329	4.265	32.688	5.017	35.014	5.824	37.305	6.685	39.559	7.597	30	30 (H)**
25	10.144	0.514	12.644	0.804	15.133	1.176	17.605	1.627	20.057	2.155	22.482	2.759	24.878	3.435	27.240	4.181	29.563	4.994	31.843	5.870	34.077	6.806	36.262	7.798	38.394	8.842	25	
23	9.934	0.535	12.430	0.850	14.913	1.253	17.376	1.741	19.814	2.313	22.220	2.964	24.591	3.692	26.921	4.493	29.205	5.364	31.440	6.300	33.620	7.297	35.742	8.349			23	25 (P)*
20	9.616	0.579	12.106	0.941	14.576	1.401	17.018	1.958	19.426	2.607	21.792	3.345	24.109	4.165	26.373	5.064	28.577	6.036	30.715	7.074							20	25 (H)**
15	9.080	0.705	11.545	1.182	13.971	1.786	16.344	2.508	18.653	3.343	20.887	4.278	23.037	5.305													15	20 (P)*
14	8.970	0.744	11.427	1.253	13.837	1.895	16.186	2.663	18.461	3.545	20.651	4.531															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 12 Degrees

Δ=12°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	302.771	13.878	305.272	13.892	307.774	13.907	310.276	13.922	312.777	13.939	315.279	13.956	317.781	13.974	320.282	13.993	322.784	14.012	325.287	14.033	327.789	14.054	330.291	14.076	332.793	14.100	2500	
2200	271.241	12.240	273.743	12.256	276.245	12.273	278.746	12.290	281.248	12.309	283.750	12.328	286.252	12.349	288.754	12.370	291.256	12.393	293.759	12.416	296.261	12.440	298.763	12.466	301.266	12.492	2200	
2000	250.222	11.151	252.723	11.168	255.225	11.187	257.727	11.206	260.229	11.226	262.731	11.248	265.233	11.271	267.736	11.294	270.238	11.319	272.740	11.344	275.243	11.371	277.746	11.399	280.248	11.427	2000	
1800	229.202	10.064	231.704	10.083	234.206	10.104	236.708	10.125	239.211	10.148	241.713	10.172	244.215	10.197	246.718	10.223	249.220	10.250	251.723	10.279	254.226	10.308	256.729	10.339	259.232	10.371	1800	
1500	197.674	8.441	200.176	8.464	202.679	8.489	205.181	8.515	207.684	8.542	210.186	8.571	212.689	8.601	215.192	8.632	217.695	8.665	220.198	8.699	222.701	8.735	225.205	8.771	227.708	8.810	1500	
1200	166.147	6.833	168.650	6.863	171.152	6.893	173.655	6.925	176.159	6.959	178.662	6.995	181.165	7.032	183.669	7.072	186.173	7.113	188.676	7.156	191.180	7.200	193.684	7.246	196.189	7.294	1200	
1000	145.130	5.777	147.633	5.811	150.137	5.848	152.640	5.886	155.144	5.927	157.648	5.970	160.152	6.015	162.656	6.062	165.160	6.112	167.664	6.163	170.169	6.216	172.674	6.272	175.179	6.329	1000	
900	134.622	5.256	137.126	5.294	139.629	5.335	142.133	5.378	144.637	5.423	147.141	5.471	149.646	5.521	152.150	5.573	154.655	5.628	157.160	5.685	159.665	5.744	162.170	5.806	164.675	5.870	900	
800	124.115	4.742	126.619	4.785	129.123	4.831	131.627	4.879	134.132	4.930	136.636	4.984	139.141	5.040	141.646	5.099	144.151	5.161	146.656	5.225	149.161	5.292	151.667	5.361	154.173	5.433	800	
700	113.609	4.239	116.113	4.288	118.617	4.341	121.122	4.396	123.627	4.454	126.132	4.516	128.637	4.580	131.143	4.647	133.648	4.718	136.154	4.791	138.660	4.867	141.166	4.946	143.672	5.029	700	
600	103.103	3.752	105.608	3.810	108.113	3.871	110.618	3.935	113.124	4.003	115.630	4.075	118.135	4.150	120.641	4.228	123.148	4.310	125.654	4.396	128.160	4.485	130.667	4.577	133.174	4.673	600	
500	92.600	3.290	95.105	3.359	97.611	3.433	100.117	3.510	102.623	3.592	105.129	3.678	107.636	3.768	110.143	3.862	112.649	3.960	115.156	4.063	117.663	4.169	120.171	4.280	122.678	4.395	500	
400	82.098	2.874	84.605	2.960	87.111	3.051	89.618	3.148	92.125	3.250	94.632	3.357	97.139	3.470	99.647	3.588	102.154	3.710	104.662	3.839	107.169	3.972	109.677	4.110	112.185	4.254	400	
360	77.899	2.728	80.406	2.823	82.913	2.925	85.420	3.033	87.927	3.146	90.434	3.265	92.942	3.390	95.449	3.521	97.957	3.657	100.465	3.799	102.972	3.948	105.480	4.101	107.987	4.261	360	100 (P)*
350	76.849	2.694	79.356	2.792	81.863	2.897	84.370	3.008	86.878	3.124	89.385	3.247	91.892	3.375	94.400	3.510	96.908	3.650	99.415	3.796	101.923	3.948	104.431	4.107	106.938	4.271	350	
300	71.601	2.546	74.108	2.661	76.616	2.783	79.123	2.912	81.631	3.048	84.138	3.190	86.646	3.340	89.154	3.497	91.661	3.661	94.169	3.831	96.676	4.009	99.183	4.193	101.690	4.385	300	
250	66.354	2.449	68.862	2.587	71.369	2.733	73.877	2.888	76.384	3.051	78.892	3.222	81.399	3.401	83.906	3.589	86.413	3.785	88.919	3.990	91.425	4.202	93.931	4.423	96.436	4.653	250	
230	64.255	2.431	66.763	2.581	69.271	2.740	71.778	2.908	74.285	3.085	76.792	3.271	79.299	3.467	81.806	3.671	84.312	3.884	86.817	4.106	89.322	4.337	91.827	4.577	94.330	4.825	230	80 (P)*
200	61.107	2.440	63.615	2.613	66.122	2.795	68.629	2.988	71.135	3.192	73.641	3.406	76.147	3.630	78.651	3.864	81.156	4.109	83.659	4.363	86.161	4.629	88.663	4.904	91.163	5.190	200	
170	57.959	2.511	60.465	2.713	62.971	2.928	65.476	3.154	67.981	3.393	70.484	3.644	72.987	3.907	75.488	4.182	77.989	4.470	80.488	4.769	82.985	5.080	85.481	5.403	87.976	5.738	170	
155	56.383	2.580	58.888	2.801	61.393	3.037	63.897	3.285	66.400	3.547	68.901	3.822	71.401	4.110	73.900	4.411	76.397	4.725	78.893	5.053	81.386	5.393	83.878	5.747	86.368	6.113	155	65 (P)*
125	53.225	2.826	55.727	3.100	58.227	3.391	60.725	3.698	63.221	4.021	65.715	4.361	68.206	4.716	70.695	5.088	73.181	5.475	75.663	5.879	78.143	6.299	80.619	6.734	83.092	7.185	125	
100	50.577	3.217	53.070	3.558	55.561	3.920	58.047	4.302	60.531	4.703	63.010	5.125	65.485	5.566	67.955	6.027	70.420	6.507	72.880	7.007	75.335	7.525	77.783	8.063	80.226	8.620	100	
90	49.507	3.454	51.994	3.832	54.478	4.233	56.957	4.655	59.431	5.100	61.899	5.566	64.363	6.054	66.820	6.563	69.271	7.094	71.715	7.645	74.153	8.218	76.583	8.811	79.005	9.425	90	50 (P)*
80	48.425	3.763	50.903	4.187	53.376	4.635	55.843	5.108	58.304	5.605	60.758	6.126	63.204	6.672	65.643	7.240	68.073	7.832	70.495	8.447	72.908	9.085	75.311	9.746	77.703	10.429	80	50 (H)**
70	47.322	4.172	49.786	4.653	52.244	5.163	54.693	5.699	57.133	6.263	59.564	6.853	61.985	7.470	64.396	8.113	66.795	8.782	69.183	9.476	71.559	10.195	73.921	10.938	76.271	11.706	70	
60	46.181	4.729	48.623	5.286	51.055	5.874	53.475	6.493	55.883	7.143	58.278	7.822	60.658	8.530	63.024	9.268	65.375	10.034	67.710	10.828	70.028	11.649	72.328	12.496	74.611	13.370	60	40 (P)*
55	45.586	5.087	48.012	5.691	50.425	6.328	52.824	6.997	55.208	7.700	57.576	8.433	59.927	9.198	62.261	9.993	64.577	10.818	66.873	11.671	69.150	12.553	71.406	13.462	73.640	14.399	55	
50	44.965	5.517	47.369	6.176	49.756	6.870	52.127	7.599	54.479	8.362	56.812	9.158	59.125	9.987	61.417	10.848	63.686	11.740	65.932	12.661	68.155	13.612	70.352	14.590	72.524	15.596	50	40 (H)**
45	44.305	6.041	46.678	6.764	46.031	7.525	51.363	8.324	53.673	9.158	55.958	10.028	58.219	10.931	60.453	11.867	62.660	12.835	64.839	13.833	66.990	14.860	69.110	15.915	71.199	16.997	45	35 (P)*
40	43.583	6.689	45.914	7.490	48.219	8.331	50.497	9.211	52.746	10.129	54.965	11.083	57.153	12.072	59.309	13.094	61.431	14.147	63.518	15.231							40	30 (H)**
35	42.763	7.506	45.031	8.400	47.266	9.336	49.465	10.312	51.628	11.327	53.752	12.379															35	
33	42.394	7.894	44.628	8.830	46.825	9.809	48.983	10.828	51.100	11.886																	33	30 (P)*
30	41.774	8.557	43.945	9.562	46.073	10.610	48.154																				30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 13 Degrees

Δ = 13°

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	292.339	16.178	294.840	16.181	297.340	16.185	299.841	16.189	302.341	16.195	304.842	16.201	307.343	16.208	309.844	16.216	312.345	16.225	314.845	16.235	317.347	16.245	319.848	16.257	322.349	16.269	2500	
2200	258.159	14.238	260.659	14.241	263.160	14.245	265.660	14.250	268.161	14.257	270.662	14.264	273.163	14.272	275.664	14.281	278.165	14.291	280.666	14.302	283.167	14.314	285.669	14.327	288.170	14.341	2200	
2000	235.372	12.944	237.872	12.948	240.373	12.952	242.873	12.958	245.374	12.965	247.875	12.973	250.376	12.982	252.877	12.992	255.378	13.003	257.879	13.015	260.381	13.028	262.883	13.042	265.384	13.057	2000	
1800	212.585	11.651	215.085	11.655	217.586	11.660	220.086	11.667	222.587	11.674	225.088	11.683	227.589	11.693	230.090	11.704	232.592	11.716	235.093	11.729	237.595	11.744	240.097	11.760	242.598	11.776	1800	
1500	178.404	9.711	180.905	9.716	183.405	9.722	185.906	9.730	188.407	9.739	190.908	9.749	193.410	9.761	195.911	9.774	198.413	9.789	200.914	9.805	203.416	9.823	205.918	9.842	208.420	9.862	1500	
1200	144.224	7.771	146.724	7.778	149.225	7.786	151.726	7.795	154.227	7.806	156.729	7.820	159.230	7.834	161.732	7.851	164.234	7.869	166.736	7.889	169.239	7.911	171.741	7.935	174.244	7.960	1200	
1000	121.437	6.479	123.937	6.486	126.439	6.496	128.940	6.508	131.441	6.521	133.943	6.537	136.445	6.555	138.947	6.575	141.449	6.596	143.952	6.621	146.454	6.647	148.957	6.675	151.461	6.706	1000	
900	110.043	5.833	112.544	5.841	115.045	5.852	117.547	5.865	120.048	5.880	122.550	5.897	125.052	5.917	127.555	5.939	130.057	5.964	132.560	5.990	135.063	6.020	137.566	6.051	140.070	6.085	900	
800	98.650	5.187	101.151	5.197	103.652	5.208	106.154	5.223	108.655	5.240	111.158	5.260	113.660	5.282	116.162	5.307	118.665	5.334	121.168	5.365	123.672	5.397	126.175	5.433	128.679	5.471	800	
700	87.256	4.542	89.758	4.553	92.259	4.566	94.761	4.583	97.263	4.602	99.765	4.625	102.268	4.650	104.771	4.678	107.274	4.710	109.778	4.745	112.281	4.782	114.785	4.823	117.289	4.866	700	100 (P)*
600	75.863	3.897	78.364	3.910	80.866	3.926	83.368	3.945	85.871	3.967	88.373	3.994	90.876	4.023	93.380	4.057	95.883	4.093	98.387	4.134	100.892	4.177	103.396	4.224	105.901	4.275	600	
500	64.470	3.254	66.971	3.269	69.473	3.287	71.976	3.310	74.479	3.338	76.982	3.369	79.486	3.405	81.989	3.445	84.494	3.489	86.998	3.537	89.503	3.589	92.009	3.646	94.514	3.707	500	
400	53.077	2.612	55.579	2.630	58.081	2.654	60.584	2.682	63.088	2.716	65.592	2.756	68.096	2.800	70.601	2.850	73.106	2.905	75.611	2.965	78.117	3.031	80.623	3.102	83.130	3.177	400	
360	48.520	2.355	51.022	2.376	53.525	2.402	56.028	2.434	58.532	2.472	61.036	2.515	63.541	2.565	66.046	2.620	68.551	2.681	71.057	2.748	73.564	2.821	76.070	2.900	78.577	2.984	360	
350	47.380	2.292	49.883	2.312	52.385	2.339	54.889	2.372	57.393	2.411	59.897	2.456	62.402	2.507	64.907	2.564	67.413	2.627	69.919	2.696	72.425	2.771	74.932	2.851	77.439	2.938	350	
300	41.684	1.972	44.187	1.997	46.690	2.028	49.194	2.067	51.698	2.112	54.203	2.165	56.708	2.224	59.214	2.290	61.721	2.364	64.228	2.444	66.735	2.531	69.242	2.625	71.750	2.727	300	80 (P)*
250	35.988	1.655	38.491	1.685	40.995	1.722	43.499	1.768	46.004	1.823	48.510	1.886	51.016	1.957	53.523	2.037	56.030	2.125	58.538	2.221	61.046	2.326	63.554	2.439	66.063	2.560	250	
230	33.710	1.529	36.213	1.561	38.717	1.602	41.222	1.652	43.727	1.711	46.233	1.780	48.740	1.857	51.247	1.944	53.754	2.039	56.262	2.144	58.771	2.258	61.279	2.381	63.788	2.513	230	
200	30.292	1.341	32.796	1.378	35.300	1.425	37.806	1.483	40.312	1.551	42.818	1.629	45.326	1.718	47.833	1.818	50.342	1.928	52.850	2.048	55.359	2.179	57.868	2.320	60.377	2.472	200	
170	26.875	1.155	29.379	1.199	31.884	1.254	34.390	1.322	36.897	1.402	39.404	1.494	41.912	1.599	44.421	1.716	46.929	1.845	49.438	1.987	51.947	2.141	54.456	2.307	56.965	2.485	170	65 (P)*
155	25.166	1.064	27.671	1.111	30.176	1.172	32.683	1.246	35.190	1.334	37.698	1.435	40.206	1.550	42.715	1.679	45.224	1.820	47.733	1.976	50.242	2.144	52.750	2.326	55.259	2.522	155	
125	21.750	0.884	24.255	0.943	26.762	1.018	29.269	1.110	31.777	1.219	34.286	1.345	36.794	1.487	39.303	1.646	41.812	1.822	44.321	2.014	46.829	2.223	49.336	2.448	51.843	2.690	125	
100	18.903	0.747	21.409	0.815	23.917	0.909	26.425	1.024	28.934	1.160	31.443	1.317	33.952	1.495	36.460	1.693	38.968	1.912	41.474	2.152	43.979	2.412	46.483	2.693	48.984	2.994	100	
90	17.764	0.687	20.271	0.769	22.779	0.873	25.288	1.001	27.797	1.152	30.306	1.327	32.814	1.524	35.322	1.744	37.828	1.987	40.333	2.253	42.835	2.542	45.336	2.853	47.833	3.187	90	50 (P)*
80	16.626	0.635	19.133	0.727	21.642	0.845	24.151	0.989	26.660	1.159	29.168	1.354	31.675	1.576	34.182	1.824	36.686	2.097	39.187	2.395	41.686	2.719	44.182	3.069	46.673	3.443	80	50 (H)**
70	15.488	0.588	17.996	0.692	20.505	0.827	23.014	0.991	25.522	1.185	28.029	1.409	30.535	1.662	33.038	1.944	35.539	2.255	38.035	2.596	40.528	2.965	43.015	3.362	45.497	3.788	70	
60	14.350	0.545	16.859	0.667	19.367	0.824	21.876	1.016	24.383	1.242	26.888	1.502	29.391	1.796	31.889	2.125	34.382	2.487	36.870	2.882	39.352	3.310	41.826	3.772	44.292	4.265	60	40 (P)*
55	13.781	0.527	16.290	0.660	18.799	0.831	21.307	1.040	23.813	1.286	26.316	1.570	28.815	1.891	31.309	2.248	33.798	2.642	36.279	3.072	38.752	3.537	41.216	4.038	43.670	4.574	55	
50	13.213	0.512	15.721	0.658	18.230	0.847	20.737	1.076	23.241	1.346	25.742	1.658	28.237	2.010	30.725	2.402	33.206	2.833	35.678	3.304	38.140	3.814	40.590	4.362	43.028	4.948	50	40 (H)**
45	12.644	0.501	15.153	0.663	17.661	0.872	20.166	1.127	22.668	1.427	25.164	1.772	27.653	2.162	30.133	2.595	32.603	3.073	35.062	3.593	37.508	4.156	39.939	4.760	42.355	5.405	45	35 (P)*
40	12.075	0.494	14.584	0.677	17.091	0.912	19.594	1.198	22.091	1.534	24.580	1.921	27.060	2.358	29.528	2.849	31.983	3.377	34.422	3.958	36.845	4.585	39.249	5.258	41.632	5.974	40	35 (H) 30 (P)*
35	11.507	0.496	14.015	0.704	16.519	0.972	19.018	1.298	21.508	1.681	23.987	2.121	26.452	2.617	28.902	3.168	31.333	3.772	33.744	4.428	36.131	5.136	38.494	5.892	40.830	6.697	35	
33	11.279	0.499	13.787	0.720	16.290	1.004	18.786	1.349	21.272	1.755	23.745	2.220	26.202	2.745	28.642	3.326	31.060	3.964	33.455	4.656	35.824	5.400	38.165	6.196	40.475	7.041	33	
30	10.938	0.508	13.444	0.751	15.944	1.062	18.435	1.441	20.913	1.886	23.375	2.396	25.817	2.969	28.236	3.603	30.630	4.298	32.995	5.050	35.329	5.859	37.628	6.720	39.890	7.633	30	30 (H)**
25	10.369	0.538	12.871	0.829	15.363	1.201	17.839	1.652	20.295	2.181	22.726	2.785	25.128	3.462	27.496	4.209	29.826	5.022	32.114	5.899	34.357	6.836	36.550	7.829	38.691	8.874	25	
23	10.140	0.557	12.640	0.873	15.126	1.276	17.593	1.765	20.036	2.337	22.448	2.989	24.826	3.717	27.162	4.520	29.454	5.391	31.697	6.328	33.896	7.326	36.018	8.379			23	25 (P)*
20	9.797	0.599	12.290	0.961	14.764	1.422	17.211	1.979	19.624	2.629	21.997	3.367	24.322	4.189	26.593	5.088	28.805	6.061	30.953	7.099							20	25 (H)**
15	9.218	0.721	11.687	1.198	14.118	1.802	16.498	2.525	18.814	3.360	21.056	4.297	23.215	5.325													15	20 (P)*
14	9.099	0.758	11.561	1.267	13.976	1.910	16.332	2.679	18.615	3.562	20.814	4.549															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 13 Degrees

△=13°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	324.851	16.282	327.352	16.295	329.854	16.310	332.356	16.326	334.857	16.342	337.359	16.359	339.861	16.377	342.363	16.396	344.865	16.416	347.367	16.437	349.870	16.458	352.372	16.480	354.875	16.503	2500	
2200	290.672	14.355	293.173	14.371	295.675	14.388	298.177	14.406	300.679	14.424	303.181	14.444	305.683	14.464	308.186	14.486	310.688	14.508	313.190	14.531	315.693	14.555	318.196	14.581	320.698	14.607	2200	
2000	267.886	13.074	270.388	13.091	272.890	13.109	275.392	13.129	277.894	13.149	280.396	13.171	282.898	13.193	285.401	13.217	287.904	13.241	290.406	13.267	292.909	13.294	295.412	13.322	297.915	13.350	2000	
1800	245.100	11.795	247.602	11.814	250.104	11.834	252.607	11.856	255.109	11.878	257.612	11.902	260.114	11.927	262.617	11.954	265.120	11.981	267.623	12.010	270.126	12.039	272.629	12.070	275.132	12.102	1800	
1500	210.923	9.884	213.425	9.906	215.928	9.931	218.430	9.957	220.933	9.984	223.436	10.013	225.939	10.043	228.442	10.074	230.946	10.107	233.449	10.142	235.953	10.177	238.456	10.214	240.960	10.252	1500	
1200	176.747	7.987	179.250	8.016	181.753	8.047	184.256	8.079	186.759	8.113	189.263	8.149	191.767	8.187	194.271	8.226	196.775	8.267	199.279	8.310	201.783	8.354	204.288	8.401	206.792	8.448	1200	
1000	153.964	6.738	156.467	6.773	158.971	6.809	161.475	6.848	163.979	6.889	166.483	6.932	168.987	6.977	171.492	7.024	173.997	7.073	176.502	7.125	179.007	7.178	181.512	7.234	184.017	7.292	1000	
900	142.573	6.121	145.077	6.159	147.581	6.200	150.085	6.243	152.590	6.289	155.094	6.336	157.599	6.386	160.104	6.439	162.609	6.494	165.114	6.551	167.620	6.610	170.125	6.672	172.631	6.736	900	
800	131.183	5.511	133.687	5.554	136.192	5.600	138.696	5.649	141.201	5.700	143.706	5.754	146.212	5.810	148.717	5.869	151.223	5.930	153.728	5.995	156.234	6.061	158.741	6.131	161.247	6.203	800	
700	119.794	4.912	122.299	4.961	124.804	5.014	127.309	5.069	129.814	5.128	132.320	5.189	134.826	5.253	137.332	5.321	139.838	5.391	142.344	5.465	144.851	5.541	147.358	5.620	149.864	5.703	700	
600	108.406	4.329	110.911	4.387	113.417	4.448	115.923	4.513	118.429	4.581	120.935	4.652	123.442	4.727	125.948	4.806	128.455	4.888	130.962	4.974	133.470	5.063	135.977	5.155	138.485	5.251	600	
500	97.020	3.771	99.526	3.841	102.033	3.914	104.539	3.992	107.046	4.073	109.553	4.159	112.060	4.249	114.568	4.344	117.076	4.442	119.584	4.544	122.092	4.651	124.600	4.762	127.108	4.877	500	
400	85.637	3.259	88.144	3.345	90.651	3.437	93.159	3.534	95.667	3.636	98.175	3.743	100.683	3.855	103.192	3.973	105.700	4.096	108.209	4.225	110.717	4.358	113.226	4.497	115.735	4.641	400	
360	81.085	3.074	83.592	3.170	86.100	3.272	88.608	3.380	91.116	3.493	93.625	3.613	96.133	3.738	98.642	3.868	101.151	4.005	103.660	4.147	106.169	4.296	108.678	4.449	111.187	4.609	360	100 (P)*
350	79.947	3.031	82.455	3.130	84.962	3.234	87.471	3.345	89.979	3.462	92.488	3.584	94.996	3.713	97.505	3.848	100.014	3.988	102.523	4.134	105.032	4.287	107.541	4.445	110.050	4.610	350	
300	74.258	2.835	76.767	2.950	79.275	3.072	81.784	3.201	84.292	3.337	86.801	3.480	89.310	3.630	91.819	3.787	94.328	3.951	96.837	4.122	99.346	4.299	101.855	4.484	104.363	4.676	300	
250	68.571	2.690	71.080	2.828	73.589	2.975	76.098	3.129	78.607	3.292	81.116	3.464	83.625	3.644	86.133	3.832	88.642	4.028	91.150	4.233	93.658	4.445	96.165	4.667	98.673	4.896	250	
230	66.297	2.654	68.806	2.804	71.315	2.963	73.824	3.131	76.333	3.308	78.841	3.495	81.350	3.690	83.858	3.894	86.366	4.107	88.873	4.329	91.380	4.561	93.887	4.801	96.393	5.050	230	80 (P)*
200	62.886	2.634	65.394	2.806	67.903	2.989	70.412	3.183	72.920	3.386	75.428	3.600	77.935	3.824	80.442	4.059	82.948	4.304	85.454	4.559	87.959	4.824	90.462	5.100	92.965	5.386	200	
170	59.474	2.676	61.982	2.878	64.490	3.093	66.997	3.320	69.504	3.559	72.009	3.810	74.514	4.074	77.018	4.349	79.521	4.636	82.023	4.936	84.523	5.247	87.022	5.570	89.519	5.906	170	
155	57.767	2.730	60.274	2.952	62.781	3.188	65.287	3.436	67.792	3.698	70.296	3.973	72.799	4.262	75.300	4.563	77.800	4.878	80.299	5.206	82.795	5.547	85.290	5.900	87.783	6.267	155	65 (P)*
125	54.348	2.948	56.852	3.223	59.354	3.514	61.855	3.821	64.354	4.145	66.851	4.484	69.345	4.840	71.837	5.212	74.327	5.600	76.813	6.004	79.296	6.424	81.776	6.860	84.253	7.311	125	
100	51.483	3.316	53.980	3.657	56.473	4.019	58.964	4.401	61.450	4.803	63.933	5.225	66.412	5.667	68.886	6.128	71.356	6.609	73.820	7.109	76.279	7.628	78.733	8.167	81.180	8.724	100	
90	50.327	3.543	52.818	3.922	55.305	4.323	57.788	4.746	60.266	5.194	62.739	5.657	65.206	6.146	67.668	6.656	70.124	7.187	72.573	7.739	75.015	8.312	77.450	8.906	79.878	9.520	90	50 (P)*
80	49.160	3.843	51.643	4.267	54.120	4.716	56.591	5.189	59.056	5.687	61.514	6.209	63.966	6.754	66.409	7.324	68.845	7.916	71.272	8.532	73.690	9.171	76.099	9.832	78.498	10.516	80	50 (H)**
70	47.973	4.243	50.442	4.725	52.904	5.234	55.358	5.772	57.803	6.336	60.239	6.927	62.666	7.544	65.082	8.188	67.487	8.857	69.881	9.552	72.263	10.271	74.632	11.016	76.989	11.784	70	
60	46.749	4.791	49.197	5.348	51.634	5.937	54.059	6.557	56.473	7.207	58.873	7.887	61.260	8.596	63.633	9.334	65.990	10.101	68.332	10.895	70.657	11.717	72.965	12.566	75.255	13.440	60	40 (P)*
55	46.114	5.145	48.545	5.749	50.963	6.386	53.368	7.057	55.758	7.759	58.133	8.494	60.491	9.259	62.832	10.055	65.155	10.880	67.459	11.735	69.743	12.618	72.007	13.528	74.250	14.465	55	
50	45.452	5.570	47.862	6.229	50.256	6.924	52.633	7.654	54.992	8.417	57.332	9.215	59.652	10.045	61.951	10.906	64.228	11.799	66.483	12.721	68.713	13.672	70.920	14.652	73.100	15.658	50	40 (H)**
45	44.753	6.090	47.133	6.814	49.493	7.576	51.832	8.375	54.148	9.210	56.441	10.080	58.710	10.984	60.952	11.921	63.168	12.890	65.356	13.889	67.515	14.917	69.645	15.974	71.743	17.057	45	35 (P)*
40	43.994	6.734	46.331	7.535	48.643	8.377	50.929	9.258	53.186	10.177	55.414	11.132	57.611	12.121	59.775	13.144	61.906	14.199	64.003	15.283							40	30 (H)**
35	43.137	7.547	45.412	8.441	47.655	9.378	49.863	10.356	52.034	11.372	54.168	12.424															35	
33	42.753	7.933	44.995	8.870	47.201	9.850	49.368	10.870	51.495	11.929																	33	30 (P)*
30	42.112	8.593	44.293	9.600	46.430	10.649																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 14 Degrees

$\Delta = 14°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	314.462	18.779	316.962	18.782	319.463	18.786	321.963	18.791	324.464	18.796	326.965	18.802	329.465	18.809	331.966	18.818	334.468	18.826	336.968	18.836	339.470	18.846	341.971	18.858	344.472	18.870	2500	
2200	277.626	16.527	280.127	16.530	282.627	16.534	285.128	16.540	287.629	16.546	290.130	16.553	292.631	16.561	295.132	16.570	297.633	16.580	300.134	16.591	302.635	16.603	305.137	16.616	307.639	16.630	2200	
2000	253.070	15.025	255.570	15.029	258.071	15.033	260.571	15.039	263.072	15.046	265.573	15.054	268.074	15.063	270.575	15.073	273.077	15.084	275.578	15.096	278.080	15.109	280.581	15.123	283.083	15.138	2000	
1800	228.513	13.523	231.013	13.528	233.514	13.533	236.015	13.539	238.516	13.547	241.017	13.556	243.518	13.566	246.019	13.577	248.520	13.589	251.022	13.602	253.524	13.617	256.026	13.633	258.528	13.649	1800	
1500	191.678	11.272	194.178	11.277	196.679	11.283	199.180	11.290	201.681	11.300	204.182	11.310	206.683	11.322	209.185	11.335	211.687	11.350	214.189	11.366	216.691	11.384	219.193	11.403	221.695	11.423	1500	
1200	154.842	9.020	157.343	9.026	159.844	9.034	162.345	9.044	164.846	9.055	167.348	9.068	169.850	9.083	172.352	9.100	174.854	9.118	177.356	9.138	179.859	9.160	182.361	9.184	184.864	9.209	1200	
1000	130.286	7.520	132.786	7.527	135.288	7.537	137.789	7.548	140.291	7.562	142.792	7.577	145.294	7.595	147.797	7.615	150.299	7.637	152.802	7.661	155.305	7.687	157.808	7.716	160.312	7.746	1000	
900	118.007	6.770	120.508	6.778	123.010	6.788	125.511	6.801	128.013	6.816	130.515	6.834	133.017	6.854	135.520	6.876	138.022	6.900	140.525	6.927	143.029	6.956	145.532	6.988	148.036	7.022	900	
800	105.729	6.020	108.230	6.029	110.731	6.041	113.233	6.055	115.735	6.072	118.237	6.092	120.740	6.115	123.243	6.139	125.746	6.167	128.249	6.197	130.753	6.230	133.257	6.265	135.761	6.303	800	
700	93.451	5.271	95.952	5.281	98.454	5.294	100.955	5.311	103.458	5.331	105.960	5.353	108.463	5.379	110.966	5.407	113.470	5.438	115.974	5.473	118.478	5.510	120.982	5.551	123.487	5.594	700	100 (P)*
600	81.173	4.522	83.674	4.534	86.176	4.550	88.678	4.569	91.181	4.592	93.684	4.618	96.187	4.648	98.691	4.681	101.195	4.718	103.699	4.758	106.204	4.802	108.709	4.849	111.214	4.900	600	
500	68.895	3.774	71.396	3.789	73.898	3.807	76.401	3.831	78.904	3.858	81.408	3.889	83.911	3.925	86.416	3.965	88.920	4.009	91.425	4.057	93.931	4.110	96.437	4.166	98.943	4.227	500	
400	56.617	3.028	59.119	3.046	61.621	3.070	64.125	3.099	66.628	3.133	69.133	3.172	71.637	3.217	74.143	3.267	76.648	3.321	79.154	3.382	81.661	3.447	84.168	3.518	86.675	3.594	400	
360	51.706	2.730	54.208	2.750	56.711	2.776	59.214	2.809	61.718	2.847	64.223	2.890	66.728	2.940	69.234	2.995	71.740	3.056	74.247	3.123	76.754	3.196	79.261	3.275	81.769	3.359	360	
350	50.478	2.656	52.980	2.677	55.483	2.704	57.987	2.737	60.491	2.775	62.996	2.820	65.501	2.871	68.007	2.928	70.513	2.991	73.020	3.060	75.527	3.135	78.035	3.216	80.542	3.303	350	
300	44.339	2.284	46.842	2.309	49.345	2.341	51.849	2.379	54.354	2.425	56.860	2.477	59.366	2.536	61.872	2.603	64.379	2.676	66.887	2.757	69.395	2.844	71.903	2.938	74.412	3.040	300	80 (P)*
250	38.201	1.915	40.704	1.945	43.208	1.982	45.713	2.029	48.218	2.083	50.725	2.146	53.231	2.217	55.739	2.297	58.247	2.385	60.755	2.482	63.264	2.587	65.773	2.700	68.283	2.821	250	
230	35.745	1.768	38.249	1.800	40.753	1.841	43.258	1.892	45.764	1.951	48.271	2.019	50.778	2.097	53.286	2.183	55.795	2.279	58.303	2.384	60.813	2.498	63.322	2.621	65.832	2.753	230	
200	32.062	1.549	34.566	1.586	37.071	1.633	39.577	1.691	42.084	1.759	44.591	1.838	47.099	1.927	49.608	2.026	52.117	2.137	54.626	2.257	57.136	2.388	59.646	2.529	62.157	2.681	200	
170	28.380	1.332	30.884	1.379	33.390	1.431	35.897	1.499	38.404	1.579	40.912	1.672	43.421	1.776	45.931	1.894	48.440	2.023	50.950	2.165	53.461	2.319	55.971	2.485	58.482	2.663	170	65 (P)*
155	26.538	1.225	29.043	1.272	31.549	1.333	34.057	1.408	36.565	1.496	39.073	1.597	41.583	1.712	44.092	1.841	46.603	1.982	49.113	2.138	51.623	2.307	54.134	2.489	56.644	2.684	155	
125	22.856	1.014	25.362	1.073	27.869	1.149	30.378	1.241	32.887	1.350	35.396	1.476	37.907	1.618	40.417	1.777	42.927	1.953	45.438	2.145	47.947	2.354	50.457	2.580	52.965	2.822	125	
100	19.789	0.840	22.296	0.919	24.804	1.013	27.313	1.129	29.823	1.265	32.334	1.423	34.844	1.600	37.354	1.798	39.864	2.017	42.372	2.257	44.880	2.518	47.386	2.799	49.896	3.101	100	
90	18.562	0.781	21.069	0.862	23.578	0.967	26.088	1.095	28.598	1.247	31.109	1.421	33.619	1.618	36.128	1.839	38.637	2.082	41.144	2.348	43.649	2.637	46.152	2.949	48.652	3.283	90	50 (P)*
80	17.335	0.719	19.843	0.811	22.353	0.928	24.863	1.072	27.373	1.243	29.883	1.439	32.393	1.660	34.901	1.908	37.407	2.181	39.912	2.480	42.413	2.805	44.912	3.155	47.407	3.529	80	50 (H)**
70	16.108	0.661	18.617	0.765	21.127	0.900	23.638	1.065	26.148	1.259	28.657	1.482	31.165	1.736	33.671	2.018	36.174	2.330	38.674	2.671	41.169	3.040	43.660	3.438	46.146	3.865	70	
60	14.882	0.600	17.392	0.730	19.902	0.887	22.412	1.079	24.922	1.305	27.429	1.566	29.934	1.860	32.435	2.189	34.932	2.551	37.423	2.947	39.908	3.376	42.387	4.838	44.857	4.332	60	40 (P)*
55	14.269	0.585	16.779	0.718	19.290	0.889	21.800	1.098	24.308	1.345	26.813	1.629	29.315	1.949	31.813	2.307	34.304	2.701	36.789	3.132	39.267	3.598	41.735	4.099	44.194	4.636	55	
50	13.657	0.564	16.167	0.711	18.677	0.899	21.186	1.129	23.693	1.400	26.196	1.711	28.694	2.063	31.186	2.456	33.670	2.888	36.146	3.359	38.613	3.870	41.068	4.418	43.511	5.004	50	40 (H)**
45	13.044	0.548	15.554	0.710	18.064	0.919	20.572	1.174	23.076	1.475	25.575	1.820	28.067	2.210	30.551	2.645	33.026	3.123	35.489	3.644	37.940	4.207	40.376	4.812	42.798	5.457	45	35 (P)*
40	12.431	0.536	14.942	0.719	17.450	0.954	19.956	1.240	22.456	1.577	24.949	1.965	27.432	2.402	29.905	2.888	32.364	3.427	34.809	4.004	37.237	4.631	39.647	5.305	42.036	6.027	40	35 (H) 30 (P)*
35	11.819	0.532	14.329	0.747	16.835	1.009	19.337	1.335	21.830	1.719	24.313	2.160	26.783	2.656	29.237	3.207	31.674	3.812	34.090	4.469	36.484	5.177	38.854	5.934	41.197	6.740	35	
33	11.574	0.534	14.083	0.755	16.589	1.039	19.088	1.384	21.577	1.791	24.054	2.257	26.516	2.782	28.961	3.364	31.385	4.002	33.786	4.695	36.162	5.440	38.510	6.237	40.827	7.082	33	
30	11.206	0.539	13.715	0.783	16.217	1.094	18.712	1.473	21.193	1.919	23.659	2.429	26.107	3.003	28.532	3.638	30.932	4.333	33.303	5.087	35.644	5.896	37.950	6.758	40.220	7.671	30	30 (H)**
25	10.593	0.564	13.098	0.856	15.593	1.228	18.073	1.680	20.534	2.209	22.970	2.814	25.378	3.491	27.753	4.239	30.090	5.053	32.386	5.931	34.637	6.869	36.839	7.863	38.989	8.909	25	
23	10.347	0.582	12.850	0.898	15.340	1.302	17.811	1.791	20.259	2.363	22.677	3.015	25.060	3.745	27.404	4.548	29.704	5.420	31.955	6.358	34.153	7.357	36.294	8.412			23	25 (P)*
20	9.978	0.620	12.474	0.982	14.952	1.444	17.404	2.002	19.823	2.653	22.202	3.391	24.534	4.214	26.814	5.114	29.034	6.088	31.191	7.127							20	25 (H)**
15	9.356	0.737	11.830	1.215	14.266	1.819	16.652	2.543	18.975	3.379	21.226	4.317	23.394	5.346													15	20 (P)*
14	9.229	0.773	11.695	1.283	14.116	1.927	16.479	2.696	18.770	3.580	20.977	4.568															14	20 (H)**

*P – Plain & Rolling Terrian **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 14 Degrees

$\Delta = 14°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	T_N	E_N	metre	
2500	346.974	18.883	349.476	18.897	351.977	18.911	354.479	18.927	356.981	18.943	359.483	18.961	361.985	18.979	364.487	18.998	366.990	19.017	369.492	19.038	371.994	19.059	374.497	19.082	377.000	19.104	2500	
2200	310.140	16.645	312.642	16.660	315.144	16.677	317.646	16.695	320.148	16.713	322.651	16.733	325.153	16.753	327.656	16.775	330.158	16.797	332.660	16.821	335.163	16.845	337.666	16.870	340.169	16.896	2200	
2000	285.585	15.155	288.087	15.172	290.589	15.190	293.091	15.210	295.594	15.230	298.096	15.252	300.599	15.274	303.101	15.298	305.604	15.323	308.107	15.348	310.610	15.375	313.113	15.403	315.616	15.432	2000	
1800	261.030	13.668	263.532	13.687	266.034	13.707	268.537	13.729	271.039	13.751	273.542	13.775	276.045	13.801	278.548	13.827	281.051	13.854	283.554	13.883	286.057	13.912	288.561	13.943	291.064	13.975	1800	
1500	224.198	11.444	226.700	11.468	229.203	11.492	231.706	11.518	234.209	11.545	236.712	11.574	239.216	11.604	241.719	11.635	244.223	11.668	246.726	11.703	249.230	11.738	251.734	11.775	254.239	11.814	1500	
1200	187.367	9.236	189.870	9.265	192.374	9.296	194.877	9.328	197.381	9.362	199.885	9.398	202.389	9.436	204.893	9.475	207.398	9.516	209.902	9.559	212.407	9.603	214.912	9.650	217.417	9.698	1200	
1000	162.815	7.779	165.319	7.813	167.823	7.850	170.327	7.889	172.831	7.930	175.336	7.973	177.841	8.018	180.346	8.065	182.851	8.115	185.356	8.166	187.862	8.219	190.367	8.275	192.873	8.333	1000	
900	150.540	7.058	153.044	7.096	155.548	7.137	158.053	7.180	160.558	7.226	163.063	7.273	165.568	7.323	168.073	7.376	170.579	7.431	173.085	7.488	175.591	7.547	178.097	7.609	180.603	7.673	900	
800	138.265	6.344	140.770	6.387	143.275	6.433	145.780	6.482	148.285	6.533	150.791	6.587	153.296	6.643	155.802	6.702	158.308	6.763	160.815	6.828	163.321	6.895	165.828	6.964	168.335	7.036	800	
700	125.992	5.641	128.497	5.690	131.002	5.743	133.508	5.798	136.014	5.857	138.520	5.918	141.026	5.982	143.533	6.050	146.040	6.121	148.547	6.194	151.054	6.270	153.561	6.350	156.069	6.432	700	
600	113.719	4.954	116.225	5.011	118.731	5.073	121.238	5.137	123.744	5.206	126.251	5.277	128.758	5.353	131.266	5.431	133.773	5.513	136.281	5.599	138.789	5.688	141.298	5.781	143.806	5.877	600	
500	101.449	4.292	103.956	4.361	106.463	4.435	108.970	4.513	111.478	4.594	113.986	4.680	116.494	4.771	119.002	4.865	121.511	4.964	124.019	5.066	126.528	5.173	129.038	5.284	131.547	5.399	500	
400	89.182	3.676	91.690	3.762	94.198	3.854	96.707	3.951	99.216	4.053	101.725	4.160	104.234	4.273	106.743	4.391	109.253	4.514	111.763	4.643	114.273	4.776	116.783	4.915	119.293	5.059	400	
360	84.277	3.450	86.785	3.546	89.294	3.648	91.803	3.755	94.312	3.869	96.822	3.988	99.331	4.114	101.841	4.244	104.351	4.381	106.861	4.524	109.372	4.672	111.882	4.826	114.392	4.986	360	100 (P)*
350	83.051	3.396	85.559	3.495	88.068	3.599	90.577	3.710	93.087	3.827	95.596	3.950	98.105	4.079	100.616	4.213	103.126	4.354	105.636	4.500	108.147	4.653	110.657	4.812	113.167	4.976	350	
300	76.921	3.148	79.430	3.263	81.940	3.385	84.449	3.515	86.959	3.651	89.470	3.794	91.980	3.944	94.490	4.101	97.001	4.265	99.511	4.436	102.021	4.614	104.532	4.799	107.042	4.990	300	
250	70.793	2.951	73.303	3.090	75.811	3.236	78.323	3.391	80.834	3.554	83.344	3.726	85.855	3.906	88.365	4.094	90.875	4.291	93.385	4.495	95.895	4.709	98.404	4.930	100.914	5.160	250	
230	68.342	2.894	70.853	3.044	73.363	3.204	75.873	3.372	78.384	3.549	80.894	3.736	83.404	3.931	85.914	4.136	88.424	4.349	90.934	4.572	93.443	4.803	95.951	5.044	98.459	5.293	230	80 (P)*
200	64.667	2.843	67.178	3.016	69.688	3.199	72.198	3.393	74.708	3.596	77.218	3.810	79.727	4.035	82.236	4.270	84.745	4.515	87.252	4.770	89.759	5.036	92.266	5.312	94.771	5.598	200	
170	60.992	2.854	63.502	3.057	66.012	3.272	68.521	3.499	71.030	3.738	73.538	3.990	76.045	4.254	78.551	4.529	81.057	4.817	83.561	5.117	86.054	4.428	88.566	5.752	91.066	6.088	170	
155	59.154	2.893	61.663	3.116	64.172	3.351	66.680	3.600	69.188	3.862	71.694	4.138	74.199	4.426	76.703	4.728	79.206	5.043	81.707	5.371	84.207	5.713	86.705	6.067	89.201	6.434	155	65 (P)*
125	55.473	3.080	57.979	3.355	60.484	3.646	62.988	3.954	65.490	4.278	67.989	4.618	70.487	4.974	72.982	5.347	75.475	5.735	77.965	6.140	80.452	6.560	82.935	6.996	85.416	7.448	125	
100	52.392	3.422	54.891	3.765	57.388	4.127	59.881	4.509	62.372	4.912	64.858	5.334	67.341	5.776	69.819	6.238	72.293	6.719	74.762	7.220	77.225	7.739	79.684	8.279	82.136	8.837	100	
90	51.150	3.640	53.644	4.019	56.135	4.421	58.621	4.844	61.103	5.289	63.580	5.756	66.052	6.245	68.518	6.755	70.978	7.287	73.432	7.840	75.880	8.414	78.320	9.008	80.753	9.623	90	50 (P)*
80	49.897	3.929	52.383	4.354	54.864	4.804	57.340	5.277	59.809	5.776	62.272	6.298	64.728	6.844	67.177	7.414	69.618	8.007	72.050	8.624	74.474	9.263	76.889	9.925	79.294	10.609	80	50 (H)**
70	48.626	4.319	51.099	4.802	53.565	5.312	56.024	5.850	58.474	6.415	60.916	7.006	63.347	7.624	65.769	8.268	68.180	8.938	70.580	9.634	72.969	10.354	75.345	11.100	77.708	11.869	70	
60	47.319	4.858	49.771	5.416	52.213	6.005	54.644	6.626	57.064	7.276	59.470	7.957	61.853	8.667	64.242	9.405	66.607	10.173	68.955	10.969	71.288	11.791	73.603	12.641	75.901	13.516	60	40 (P)*
55	46.642	5.207	49.079	5.812	51.503	6.450	53.914	7.121	56.310	7.824	58.691	8.559	61.056	9.326	63.404	10.122	65.734	10.949	68.046	11.804	70.338	12.688	72.609	13.599	74.860	14.537	55	
50	45.941	5.628	48.356	6.287	50.756	6.983	53.140	7.713	55.506	8.478	57.853	9.276	60.180	10.107	62.487	10.969	64.772	11.862	67.034	12.786	69.273	13.738	71.488	14.719	73.678	15.726	50	40 (H)**
45	45.202	6.143	47.388	6.867	49.955	7.630	52.301	8.430	54.625	9.266	56.926	10.137	59.202	11.042	61.453	11.980	63.677	12.950	65.874	13.950	68.042	14.979	70.181	16.037	72.289	17.121	45	35 (P)*
40	44.404	6.782	46.749	7.584	49.069	8.427	51.362	9.309	53.627	10.229	55.862	11.185	58.069	12.175	60.242	13.199	62.383	14.255	64.489	15.341	-	-	-	-	-	-	40	30 (E)**
35	43.511	7.591	45.794	8.486	48.045	9.424	50.262	10.403	52.442	11.420	54.585	12.473															35	
33	43.111	7.925	45.363	8.913	47.578	9.894	49.754	10.915	51.890	11.975																	33	30 (P)*
30	42.451	8.633	44.641	9.641	46.787	10.691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	30 (H)**
25																											25	25 (H)**
23																											23	28 (P)*
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	25 (H)**
15																											15	20 (P)*
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 15 Degrees

Δ=15°

R_C	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_f	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	358.853	24.573	361.353	24.576	363.854	24.580	366.354	24.584	368.855	24.590	371.356	24.596	373.857	24.603	376.358	24.611	378.859	24.620	381.360	24.630	383.862	24.640	386.363	24.652	388.865	24.664	2500	
2200	316.690	21.625	319.191	21.628	321.691	21.633	324.192	21.638	326.693	21.644	329.194	21.651	331.695	21.659	334.196	21.669	336.698	21.679	339.199	21.689	341.701	21.702	344.202	21.714	346.704	21.728	2200	
2000	288.582	19.660	291.083	19.664	293.583	19.668	296.084	19.674	298.585	19.681	301.086	19.689	303.587	19.698	306.089	19.708	308.590	19.719	311.092	19.731	313.594	19.744	316.096	19.758	318.598	19.774	2000	
1800	260.474	17.695	262.975	17.699	265.475	17.704	267.976	17.711	270.477	17.718	272.979	17.727	275.480	17.737	277.981	17.748	280.483	17.760	282.985	17.774	285.487	17.789	287.989	17.804	290.491	17.821	1800	
1500	218.312	14.748	220.813	14.753	223.314	14.759	225.815	14.767	228.316	14.776	230.817	14.786	233.319	14.798	235.821	14.812	238.323	14.826	240.825	14.843	243.327	14.860	245.830	14.879	248.332	14.899	1500	
1200	176.150	11.801	178.651	11.807	181.152	11.815	183.653	11.825	186.155	11.836	188.657	11.849	191.159	11.864	193.661	11.881	196.163	11.899	198.666	11.919	201.169	11.941	203.672	11.965	206.175	11.990	1200	
1000	148.042	9.837	150.543	9.844	153.044	9.854	155.546	9.865	158.048	9.879	160.550	9.895	163.052	9.913	165.555	9.933	168.058	9.955	170.561	9.979	173.064	10.005	175.568	10.034	178.072	10.064	1000	
900	133.988	8.855	136.489	8.864	138.991	8.874	141.492	8.887	143.994	8.902	146.497	8.919	148.999	8.939	151.502	8.962	154.006	8.986	156.509	9.013	159.013	9.042	161.517	9.074	164.021	9.108	900	
800	119.934	7.874	122.436	7.883	124.937	7.895	127.439	7.909	129.941	7.927	132.444	7.946	134.947	7.969	137.450	7.993	139.954	8.021	142.458	8.052	144.962	8.084	147.466	8.120	149.971	8.158	800	
700	105.880	6.893	108.382	6.904	110.884	6.917	113.386	6.933	115.888	6.953	118.391	6.976	120.895	7.001	123.398	7.030	125.902	7.061	128.407	7.096	130.912	7.133	133.417	7.174	135.922	7.217	700	100 (P)*
600	91.827	5.912	94.328	5.925	96.830	5.940	99.333	5.960	101.836	5.982	104.339	6.009	106.843	6.039	109.347	6.072	111.852	6.109	114.357	6.149	116.863	6.193	119.368	6.240	121.874	6.291	600	
500	77.773	4.933	80.275	4.948	82.777	4.966	85.280	4.990	87.784	5.017	90.288	5.048	92.793	5.084	95.298	5.124	97.803	5.168	100.309	5.217	102.815	5.269	105.322	5.326	107.829	5.387	500	
400	63.720	3.955	66.222	3.973	68.725	3.997	71.229	4.026	73.733	4.060	76.238	4.099	78.744	4.144	81.250	4.194	83.756	4.249	86.263	4.310	88.771	4.375	91.279	4.446	93.788	4.522	400	
360	58.098	3.564	60.601	3.585	63.104	3.611	65.608	3.643	68.113	3.681	70.619	3.725	73.125	3.775	75.631	3.830	78.139	3.891	80.646	3.958	83.155	4.031	85.663	4.110	88.173	4.195	360	
350	56.693	3.467	59.196	3.488	61.699	3.515	64.203	3.548	66.708	3.587	69.214	3.632	71.720	3.683	74.227	3.740	76.734	3.803	79.242	3.872	81.751	3.948	84.260	4.026	86.769	4.116	350	
300	49.666	2.980	52.170	3.004	54.674	3.036	57.179	3.074	59.684	3.120	62.190	3.173	64.698	3.232	67.205	3.299	69.714	3.372	72.222	3.453	74.732	3.541	77.242	3.635	79.752	3.737	300	80 (P)*
250	42.640	2.495	45.144	2.524	47.649	2.562	50.154	2.608	52.661	2.663	55.168	2.726	57.677	2.798	60.185	2.878	62.695	2.966	65.205	3.062	67.716	3.168	70.227	3.281	72.739	3.403	250	
230	39.830	2.302	42.334	2.334	44.839	2.375	47.345	2.425	49.852	2.484	52.360	2.553	54.869	2.631	57.378	2.718	59.888	2.813	62.399	2.919	64.910	3.033	67.422	3.156	69.934	3.288	230	
200	35.614	2.013	38.119	2.050	40.625	2.097	43.132	2.155	45.640	2.223	48.148	2.302	50.658	2.391	53.168	2.491	55.679	2.601	58.191	2.722	60.703	2.854	63.216	2.995	65.729	3.147	200	
170	31.399	1.726	33.905	1.770	36.411	1.825	38.919	1.893	41.428	1.974	43.938	2.067	46.449	2.172	48.960	2.289	51.472	2.419	53.985	2.561	56.498	2.715	59.011	2.882	61.525	3.061	170	65 (P)*
155	29.292	1.584	31.798	1.632	34.305	1.693	36.813	1.768	39.323	1.856	41.833	1.957	44.344	2.073	46.857	2.201	49.369	2.344	51.882	2.499	54.396	2.668	56.909	2.851	59.423	3.047	155	
125	25.077	1.304	27.584	1.363	30.093	1.439	32.603	1.531	35.114	1.641	37.625	1.767	40.138	1.909	42.651	2.069	45.165	2.245	47.678	2.438	50.192	2.647	52.705	2.873	55.218	3.116	125	
100	21.566	1.077	24.074	1.151	26.584	1.246	29.095	1.361	31.608	1.498	34.121	1.655	36.635	1.833	39.148	2.032	41.662	2.252	44.174	2.493	46.686	2.754	49.197	3.035	51.707	3.338	100	
90	20.162	0.990	22.671	1.071	25.181	1.176	27.693	1.305	30.206	1.456	32.720	1.631	35.233	1.829	37.747	2.050	40.259	2.294	42.771	2.561	45.282	2.851	47.790	3.163	50.296	3.498	90	50 (P)*
80	18.758	0.905	21.267	0.996	23.779	1.115	26.292	1.259	28.805	1.429	31.319	1.626	33.832	1.848	36.344	2.097	38.856	2.371	41.365	2.670	43.873	2.995	46.377	3.346	48.879	3.722	80	50 (H)**
70	17.354	0.823	19.864	0.928	22.377	1.063	24.890	1.228	27.404	1.423	29.917	1.647	32.429	1.901	34.940	2.184	37.449	2.496	39.954	2.838	42.456	3.208	44.954	3.607	47.448	4.035	70	
60	15.930	0.747	18.462	0.870	20.975	1.027	23.489	1.219	26.002	1.446	28.514	1.707	31.024	2.003	33.531	2.332	36.034	2.695	38.532	3.092	41.025	3.522	43.512	3.984	45.991	4.480	60	40 (P)*
55	15.249	0.713	17.761	0.846	20.275	1.018	22.788	1.227	25.301	1.474	27.811	1.759	30.319	2.080	32.823	2.439	35.321	2.834	37.814	3.266	40.299	3.733	42.777	4.235	45.245	4.773	55	
50	14.548	0.681	17.061	0.828	19.574	1.016	22.087	1.246	24.599	1.518	27.107	1.830	29.611	2.183	32.110	2.577	34.603	3.010	37.087	3.482	39.562	3.994	42.027	4.543	44.480	5.131	50	40 (H)**
45	13.847	0.652	16.360	0.816	18.873	1.025	21.386	1.280	23.895	1.581	26.400	1.928	28.899	2.319	31.391	2.754	33.874	3.233	36.346	3.755	38.807	4.320	41.254	4.926	43.687	5.573	45	35 (P)*
40	13.146	0.629	15.659	0.813	18.172	1.048	20.683	1.335	23.189	1.673	25.688	2.061	28.180	2.499	30.661	2.986	33.129	3.522	35.584	4.105	38.024	4.734	40.445	5.402	42.848	6.128	40	35 (H) 30 (P)*
35	12.443	0.614	14.959	0.823	17.470	1.092	19.977	1.419	22.477	1.804	24.968	2.245	27.446	2.743	29.910	3.295	32.358	3.901	34.786	4.560	37.192	5.270	39.575	6.029	41.932	6.836	35	
33	12.165	0.611	14.678	0.833	17.189	1.117	19.694	1.463	22.190	1.871	24.676	2.338	27.147	2.864	29.602	3.447	32.037	4.087	34.450	4.781	36.839	5.529	39.201	6.327	41.534	7.175	33	
30	11.744	0.610	14.257	0.854	16.765	1.166	19.266	1.546	21.756	1.992	24.231	2.504	26.688	3.079	29.125	3.715	31.537	4.412	33.922	5.167	36.276	5.978	38.596	6.843	40.884	7.758	30	30 (H)**
25	11.044	0.623	13.554	0.915	16.055	1.288	18.543	1.741	21.014	2.272	23.461	2.878	25.880	3.557	28.268	4.306	30.620	5.122	32.931	6.002	35.198	6.942	37.418	7.939	39.587	8.987	25	
23	10.763	0.636	13.271	0.953	15.768	1.357	18.248	1.848	20.706	2.421	23.135	3.075	25.532	3.806	27.890	4.611	30.205	5.486	32.472	6.426	34.688	7.427	36.847	8.484			23	25 (P)*
20	10.341	0.668	12.844	1.031	15.330	1.493	17.792	2.052	20.223	2.704	22.614	3.445	24.961	4.269	27.256	5.172	29.494	6.148	31.669	7.190							20	25 (H)**
15	9.633	0.773	12.115	1.252	14.562	1.858	16.961	2.584	19.299	3.421	21.566	4.361	23.752	5.392													15	20 (P)*
14	9.490	0.807	11.964	1.318	14.397	1.963	16.773	2.734	19.079	3.620	21.304	4.611															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 15 Degrees

Δ = 15°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_N	E_S	T_M	E_S	T_S	E_S	T_R	E_S	T_S	E_S	T_R	E_S	T_R	E_S	T_R	E_R	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	369.145	21.680	371.646	21.694	374.148	21.708	376.650	21.724	379.152	21.740	381.654	21.758	384.156	21.776	386.659	21.794	389.161	21.814	391.664	21.835	394.167	21.856	396.669	21.878	399.172	21.902	2500	
2200	329.651	19.106	332.153	19.121	334.655	19.138	337.157	19.156	339.659	19.175	342.162	19.194	344.684	19.215	347.167	19.236	349.670	19.259	352.172	19.282	354.675	19.306	357.178	19.332	359.682	19.358	2200	
2000	303.322	17.392	305.824	17.410	308.326	17.428	310.828	17.447	313.331	17.468	315.834	17.490	318.336	17.512	320.840	17.535	323.343	17.560	325.846	17.586	328.349	17.613	330.852	17.641	333.355	17.669	2000	
1800	276.993	15.681	279.495	15.701	281.998	15.721	284.501	15.743	287.003	15.765	289.506	15.789	292.010	15.814	294.513	15.841	297.016	15.868	299.519	15.897	302.023	15.927	304.527	15.958	307.031	15.990	1800	
1500	237.501	13.123	240.004	13.146	242.507	13.170	245.010	13.196	247.513	13.223	250.017	13.252	252.520	13.282	255.024	13.314	257.528	13.347	260.032	13.381	262.536	13.417	265.041	13.454	267.545	13.492	1500	
1200	198.011	10.579	200.514	10.608	203.018	10.638	205.522	10.671	208.026	10.705	210.530	10.741	213.034	10.778	215.539	10.818	218.044	10.859	220.549	10.902	223.054	10.946	225.559	10.993	228.064	11.041	1200	
1000	171.685	8.898	174.189	8.932	176.694	8.969	179.198	9.008	181.703	9.049	184.208	9.092	186.713	9.137	189.219	9.185	191.724	9.234	194.230	9.285	196.736	9.339	199.242	9.395	201.748	9.452	1000	
900	158.523	8.065	161.028	8.103	163.533	8.144	166.038	8.187	168.543	8.233	171.048	8.281	173.554	8.331	176.060	8.383	178.566	8.438	181.072	8.495	183.579	8.555	186.086	8.617	188.592	8.681	900	
800	145.362	7.239	147.867	7.282	150.373	7.329	152.878	7.377	155.384	7.428	157.890	7.482	160.396	7.539	162.903	7.598	165.409	7.659	167.916	7.724	170.423	7.791	172.931	7.860	175.438	7.932	800	
700	132.202	6.424	134.708	6.474	137.214	6.527	139.720	6.582	142.227	6.641	144.733	6.702	147.240	6.766	149.747	6.834	152.255	6.905	154.762	6.978	157.270	7.054	159.779	7.134	162.287	7.217	700	
600	119.044	5.625	121.550	5.683	124.057	5.745	126.564	5.809	129.071	5.878	131.579	5.949	134.087	6.025	136.595	6.104	139.103	6.186	141.612	6.271	144.120	6.361	146.630	6.453	149.139	6.549	600	
500	105.888	4.852	108.395	4.921	110.903	4.995	113.411	5.073	115.919	5.155	118.428	5.241	120.937	5.331	123.446	5.426	125.955	5.524	128.465	5.627	130.975	5.734	133.485	5.845	135.995	5.961	500	
400	92.735	4.124	95.244	4.210	97.753	4.302	100.262	4.399	102.772	4.501	105.282	4.609	107.792	4.722	110.303	4.840	112.813	4.963	115.324	5.092	117.835	5.226	120.347	5.365	122.858	5.509	400	
360	87.476	3.853	89.985	3.945	92.495	4.052	95.005	4.159	97.515	4.273	100.026	4.393	102.536	4.518	105.047	4.649	107.559	4.786	110.070	4.928	112.582	5.077	115.093	5.231	117.605	5.391	360	100 (P)*
350	86.161	3.788	88.671	3.887	91.180	3.992	93.691	4.103	96.201	4.220	98.712	4.343	101.223	4.472	103.734	4.607	105.245	4.747	108.757	4.894	111.268	5.047	113.780	5.206	116.292	5.370	350	
300	79.589	3.485	82.099	3.600	84.610	3.722	87.121	3.852	89.632	3.988	92.144	4.131	94.655	4.281	97.167	4.439	99.679	4.603	102.191	4.774	104.703	4.952	107.215	5.137	109.727	5.329	300	
250	73.019	3.232	75.531	3.371	78.042	3.517	80.554	3.672	83.066	3.836	85.578	4.008	88.090	4.188	90.601	4.376	93.113	4.573	95.625	4.778	98.137	4.991	100.648	5.213	103.159	5.443	250	
230	70.392	3.153	72.904	3.303	75.416	3.463	77.928	3.631	80.439	3.809	82.951	3.995	85.463	4.191	87.975	4.396	90.487	4.609	92.998	4.832	95.509	5.064	98.020	5.305	100.530	5.554	230	80 (P)*
200	66.452	3.069	68.964	3.242	71.476	3.425	73.988	3.618	76.500	3.822	79.012	4.037	81.523	4.262	84.034	4.497	86.545	4.742	89.055	4.998	91.564	5.264	94.073	5.540	96.581	5.826	200	
170	62.513	3.046	65.025	3.249	67.537	3.464	70.048	3.692	72.559	3.931	75.069	4.183	77.579	4.447	80.087	4.723	82.595	5.011	85.102	5.311	87.608	5.623	90.113	5.947	92.616	6.283	170	
155	60.543	3.069	63.055	3.291	65.566	3.527	68.076	3.776	70.586	4.039	73.095	4.315	75.602	4.604	78.109	4.906	80.615	5.221	83.119	5.549	85.621	5.891	88.122	6.246	90.622	6.613	155	65 (P)*
125	56.600	3.222	59.109	3.498	61.617	3.789	64.123	4.097	66.627	4.422	69.130	4.762	71.631	5.119	74.129	5.492	76.625	5.880	79.119	6.285	81.610	6.706	84.097	7.143	86.582	7.595	125	
100	53.302	3.537	55.804	3.880	58.304	4.242	60.801	4.625	63.295	5.028	65.785	5.451	68.272	5.893	70.754	6.356	73.232	6.837	75.705	7.339	78.174	7.859	80.637	8.399	83.094	8.957	100	
90	51.974	3.744	54.472	4.124	56.966	4.525	59.456	4.949	61.942	5.395	64.423	5.863	66.899	6.352	69.370	6.863	71.835	7.395	74.293	7.948	76.746	8.523	79.191	9.118	81.630	9.734	90	50 (P)*
80	50.636	4.023	53.126	4.448	55.611	4.898	58.091	5.372	60.564	5.871	63.032	6.394	65.493	6.941	67.946	7.511	70.392	8.105	72.830	8.722	75.260	9.362	77.680	10.025	80.091	10.710	80	50 (H)**
70	49.280	4.402	51.758	4.885	54.228	5.396	56.692	5.934	59.147	6.500	61.593	7.092	64.031	7.710	66.458	8.355	68.875	9.026	71.281	9.722	73.676	10.444	76.058	11.190	78.428	11.960	70	
60	47.890	4.930	50.347	5.489	52.794	6.079	55.231	6.700	57.656	7.351	60.068	8.032	62.468	8.743	64.853	9.483	67.224	10.251	69.580	11.048	71.920	11.871	74.242	12.721	76.548	13.598	60	40 (P)*
55	47.172	5.274	49.614	5.879	52.044	6.518	54.461	7.190	56.863	7.894	59.251	8.630	61.622	9.397	63.977	10.195	66.315	11.022	68.634	11.878	70.933	12.763	73.213	13.675	75.472	14.614	55	
50	46.431	5.689	48.852	6.350	51.258	7.046	53.648	7.777	56.020	8.543	58.374	9.342	60.709	10.173	63.023	11.037	65.316	11.931	67.587	12.856	69.834	13.809	72.058	14.791	74.256	15.799	50	40 (H)**
45	45.652	6.194	48.045	6.925	50.418	7.688	52.771	8.489	55.103	9.326	57.411	10.198	59.695	11.105	61.954	12.044	64.187	13.014	66.393	14.016	68.570	15.046	70.718	16.105	72.836	17.190	45	35 (P)*
40	44.816	6.834	47.168	7.637	49.495	8.481	51.796	9.364	54.069	10.284	56.314	11.241	58.528	12.233	60.711	13.258	62.860	14.315	64.976	15.402	---	---	---	---	---	---	40	30 (H)**
35	43.886	7.638	46.177	8.535	48.436	9.474	50.661	10.453	52.851	11.471	55.003	12.526															35	
33	43.473	8.021	45.732	8.960	47.955	9.942	50.140	10.964	52.286	12.025																	33	30 (P)*
30	42.792	8.676	44.990	9.685	47.145	10.736																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 16 Degrees

$\Delta = 16°$

R_C	$L_S = 15$ metres		$L_S = 20$ metres		$L_S = 25$ metres		$L_S = 30$ metres		$L_S = 35$ metres		$L_S = 40$ metres		$L_S = 45$ metres		$L_S = 50$ metres		$L_S = 55$ metres		$L_S = 60$ metres		$L_S = 65$ metres		$L_S = 70$ metres		$L_S = 75$ metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre			
2500	358.853	24.573	361.353	24.576	363.854	24.580	366.354	24.584	368.855	24.590	371.356	24.596	373.857	24.603	376.358	24.611	378.859	24.620	381.360	24.630	383.862	24.640	386.363	24.652	388.865	24.664	**2500**	
2200	316.690	21.625	319.191	21.628	321.691	21.633	324.192	21.638	326.693	21.644	329.194	21.651	331.695	21.659	334.196	21.669	336.698	21.679	339.199	21.689	341.701	21.702	344.202	21.714	346.704	21.728	**2200**	
2000	288.582	19.660	291.083	19.664	293.583	19.668	296.084	19.674	298.585	19.681	301.086	19.689	303.587	19.698	306.089	19.708	308.590	19.719	311.092	19.731	313.594	19.744	316.096	19.758	318.598	19.774	**2000**	
1800	260.474	17.695	262.975	17.699	265.475	17.704	267.976	17.711	270.477	17.718	272.979	17.727	275.480	17.737	277.981	17.748	280.483	17.760	282.985	17.774	285.487	17.789	287.989	17.804	290.491	17.821	**1800**	
1500	218.312	14.748	220.813	14.753	223.314	14.759	225.815	14.767	228.316	14.776	230.817	14.786	233.319	14.798	235.821	14.812	238.323	14.826	240.825	14.843	243.327	14.860	245.830	14.879	248.332	14.899	**1500**	
1200	176.150	11.801	178.651	11.807	181.152	11.815	183.653	11.825	186.155	11.836	188.657	11.849	191.159	11.864	193.661	11.881	196.163	11.899	198.666	11.919	201.169	11.941	203.672	11.965	206.175	11.990	**1200**	
1000	148.042	9.837	150.543	9.844	153.044	9.854	155.546	9.865	158.048	9.879	160.550	9.895	163.052	9.913	165.555	9.933	168.058	9.955	170.561	9.979	173.064	10.005	175.568	10.034	178.072	10.064	**1000**	
900	133.988	8.855	136.489	8.864	138.991	8.874	141.492	8.887	143.994	8.902	146.497	8.919	148.999	8.939	151.502	8.962	154.006	8.986	156.509	9.013	159.013	9.042	161.517	9.074	164.021	9.108	**900**	
800	119.934	7.874	122.436	7.883	124.937	7.895	127.439	7.909	129.941	7.927	132.444	7.946	134.947	7.969	137.450	7.993	139.954	8.021	142.458	8.052	144.962	8.084	147.466	8.120	149.971	8.158	**800**	**100 (P)***
700	105.880	6.893	108.382	6.904	110.884	6.917	113.386	6.933	115.888	6.953	118.391	6.976	120.895	7.001	123.398	7.030	125.902	7.061	128.407	7.096	130.912	7.133	133.417	7.174	135.922	7.217	**700**	
600	91.827	5.912	94.328	5.925	96.830	5.940	99.333	5.960	101.836	5.982	104.339	6.009	106.843	6.039	109.347	6.072	111.852	6.109	114.357	6.149	116.863	6.193	119.368	6.240	121.874	6.291	**600**	
500	77.773	4.933	80.275	4.948	82.777	4.966	85.280	4.990	87.784	5.017	90.288	5.048	92.793	5.084	95.298	5.124	97.803	5.168	100.309	5.217	102.815	5.269	105.322	5.326	107.829	5.387	**500**	
400	63.720	3.955	66.222	3.973	68.725	3.997	71.229	4.026	73.733	4.060	76.238	4.099	78.744	4.144	81.250	4.194	83.756	4.249	86.263	4.310	88.771	4.375	91.279	4.446	93.788	4.522	**400**	
360	58.098	3.564	60.601	3.585	63.104	3.611	65.608	3.643	68.113	3.681	70.619	3.725	73.125	3.775	75.631	3.830	78.139	3.891	80.646	3.958	83.155	4.031	85.663	4.110	88.173	4.195	**360**	
350	56.693	3.467	59.196	3.488	61.699	3.515	64.203	3.548	66.708	3.587	69.214	3.632	71.720	3.683	74.227	3.740	76.734	3.803	79.242	3.872	81.751	3.948	84.260	4.028	86.769	4.116	**350**	
300	49.666	2.980	52.170	3.004	54.674	3.036	57.179	3.074	59.684	3.120	62.190	3.173	64.696	3.232	67.205	3.299	69.714	3.372	72.222	3.453	74.732	3.541	77.242	3.635	79.752	3.737	**300**	**80 (P)***
250	42.640	2.495	45.144	2.524	47.649	2.562	50.154	2.608	52.661	2.663	55.168	2.726	57.677	2.798	60.185	2.878	62.695	2.965	65.205	3.062	67.716	3.168	70.227	3.281	72.739	3.403	**250**	
230	39.830	2.302	42.334	2.334	44.839	2.375	47.345	2.425	49.852	2.484	52.360	2.553	54.869	2.631	57.378	2.718	59.888	2.813	62.399	2.919	64.910	3.033	67.422	3.156	69.934	3.288	**230**	
200	35.614	2.013	38.119	2.050	40.625	2.097	43.132	2.155	45.640	2.223	48.148	2.302	50.658	2.391	53.168	2.491	55.679	2.601	58.191	2.722	60.703	2.854	63.216	2.995	65.729	3.147	**200**	
170	31.399	1.726	33.905	1.770	36.411	1.825	38.919	1.893	41.428	1.974	43.938	2.067	46.449	2.172	48.960	2.289	51.472	2.419	53.985	2.561	56.498	2.715	59.011	2.882	61.525	3.061	**170**	**65 (P)***
155	29.292	1.584	31.798	1.632	34.305	1.693	36.813	1.768	39.323	1.856	41.833	1.957	44.344	2.073	46.857	2.201	49.369	2.344	51.882	2.499	54.396	2.668	56.909	2.851	59.423	3.047	**155**	
125	25.077	1.304	27.584	1.363	30.093	1.439	32.603	1.537	35.114	1.641	37.625	1.767	40.138	1.909	42.651	2.069	45.165	2.245	47.678	2.438	50.192	2.647	52.705	2.873	55.218	3.116	**125**	
100	21.566	1.077	24.074	1.151	26.584	1.246	29.095	1.361	31.608	1.498	34.121	1.655	36.635	1.833	39.148	2.032	41.662	2.252	44.174	2.493	46.686	2.754	49.197	3.035	51.707	3.338	**100**	
90	20.162	0.990	22.671	1.071	25.181	1.176	27.693	1.305	30.206	1.456	32.720	1.631	35.233	1.829	37.747	2.050	40.259	2.294	42.771	2.561	45.282	2.851	47.790	3.163	50.296	3.498	**90**	**50 (P)***
80	18.758	0.905	21.267	0.996	23.779	1.115	26.292	1.259	28.805	1.429	31.319	1.626	33.832	1.848	36.344	2.097	38.856	2.371	41.365	2.670	43.873	2.995	46.377	3.346	48.879	3.722	**80**	**50 (H)****
70	17.354	0.823	19.864	0.928	22.371	1.063	24.890	1.228	27.404	1.423	29.917	1.647	32.429	1.901	34.940	2.184	37.449	2.496	39.954	2.838	42.456	3.208	44.954	3.607	47.448	4.035	**70**	
60	15.950	0.747	18.462	0.870	20.975	1.027	23.489	1.219	26.002	1.446	28.514	1.707	31.024	2.003	33.531	2.332	36.034	2.695	38.532	3.092	41.025	3.522	43.512	3.984	45.991	4.480	**60**	**40 (P)***
55	15.249	0.713	17.761	0.846	20.275	1.018	22.788	1.227	25.301	1.474	27.811	1.759	30.319	2.080	32.823	2.439	35.321	2.834	37.814	3.266	40.299	3.733	42.777	4.235	45.245	4.773	**55**	
50	14.548	0.681	17.061	0.828	19.574	1.016	22.087	1.246	24.599	1.518	27.107	1.830	29.611	2.183	32.110	2.577	34.603	3.010	37.087	3.482	39.562	3.994	42.027	4.543	44.480	5.131	**50**	**40 (H)****
45	13.847	0.652	16.360	0.816	18.873	1.025	21.386	1.280	23.895	1.581	26.400	1.928	28.899	2.319	31.391	2.754	33.874	3.233	36.346	3.755	38.807	4.320	41.254	4.926	43.687	5.573	**45**	**35 (P)***
40	13.146	0.629	15.659	0.813	18.172	1.048	20.683	1.335	23.189	1.673	25.688	2.061	28.180	2.499	30.661	2.986	33.129	3.522	35.584	4.105	38.024	4.734	40.445	5.409	42.848	6.128	**40**	**35 (H) 30 (P)***
35	12.445	0.614	14.959	0.823	17.470	1.092	19.977	1.419	22.477	1.804	24.968	2.245	27.446	2.743	29.910	3.295	32.358	3.901	34.786	4.560	37.192	5.270	39.575	6.029	41.932	6.836	**35**	
33	12.165	0.611	14.678	0.833	17.189	1.117	19.694	1.463	22.190	1.871	24.676	2.338	27.147	2.864	29.602	3.447	32.037	4.087	34.450	4.781	36.839	5.529	39.201	6.327	41.534	7.175	**33**	
30	11.744	0.610	14.257	0.854	16.765	1.166	19.266	1.546	21.756	1.992	24.231	2.504	26.688	3.079	29.125	3.715	31.537	4.412	33.922	5.167	36.276	5.978	38.598	6.843	40.884	7.758	**30**	**30 (H)****
25	11.044	0.623	13.554	0.915	16.055	1.288	18.543	1.741	21.014	2.272	23.461	2.878	25.880	3.557	28.268	4.306	30.620	5.122	32.931	6.002	35.198	6.942	37.418	7.939	39.587	8.987	**25**	
23	10.763	0.636	13.271	0.953	15.768	1.357	18.248	1.848	20.706	2.421	23.135	3.075	25.532	3.806	27.890	4.611	30.205	5.486	32.472	6.426	34.688	7.427	36.847	8.484			**23**	**25 (P)***
20	10.341	0.668	12.844	1.031	15.330	1.493	17.792	2.052	20.223	2.704	22.614	3.445	24.961	4.269	27.256	5.172	29.494	6.148	31.669	7.190							**20**	**25 (H)****
15	9.633	0.773	12.115	1.252	14.562	1.858	16.961	2.584	19.299	3.421	21.566	4.361	23.752	5.392													**15**	**20 (P)***
14	9.490	0.807	11.964	1.318	14.397	1.963	16.773	2.734	19.079	3.620	21.304	4.611															**14**	**20 (H)****

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 16 Degrees

△=16°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	391.367	24.677	393.868	24.691	396.370	24.705	398.873	24.721	401.375	24.737	403.877	24.755	406.379	24.773	408.882	24.792	411.385	24.811	413.887	24.832	416.390	24.854	418.893	24.876	421.396	24.899	2500	
2200	349.206	21.743	351.708	21.759	354.210	21.776	356.713	21.793	359.216	21.812	361.718	21.832	364.221	21.852	366.724	21.874	369.227	21.896	371.729	21.920	374.233	21.944	376.736	21.969	379.240	21.996	2200	
2000	321.100	19.790	323.602	19.807	326.104	19.826	328.607	19.845	331.110	19.865	333.613	19.887	336.115	19.910	338.619	19.933	341.122	19.958	343.625	19.984	346.129	20.011	348.633	20.039	351.136	20.067	2000	
1800	292.994	17.839	295.496	17.859	297.999	17.879	300.502	17.901	303.005	17.923	305.508	17.947	308.011	17.972	310.514	17.999	313.018	18.026	315.522	18.055	318.026	18.085	320.530	18.116	323.034	18.148	1800	
1500	250.835	14.921	253.338	14.944	255.841	14.969	258.345	14.995	260.848	15.022	263.352	15.051	265.856	15.081	268.360	15.113	270.864	15.145	273.369	15.180	275.873	15.216	278.378	15.252	280.883	15.291	1500	
1200	208.679	12.018	211.182	12.047	213.686	12.077	216.190	12.109	218.695	12.144	221.199	12.180	223.704	12.218	226.209	12.257	228.714	12.298	231.220	12.341	233.725	12.385	236.231	12.432	238.737	12.480	1200	
1000	180.576	10.097	183.081	10.132	185.585	10.168	188.090	10.207	190.595	10.249	193.100	10.291	195.606	10.337	198.112	10.384	200.618	10.433	203.124	10.485	205.631	10.539	208.137	10.594	210.644	10.652	1000	
900	166.526	9.144	169.031	9.183	171.536	9.224	174.041	9.267	176.547	9.312	179.052	9.360	181.559	9.410	184.065	9.463	186.571	9.518	189.078	9.575	191.585	9.635	194.093	9.697	196.600	9.761	900	
800	152.476	8.199	154.982	8.242	157.487	8.288	159.993	8.337	162.499	8.388	165.006	8.442	167.513	8.498	170.020	8.558	172.527	8.619	175.034	8.684	177.542	8.751	180.050	8.820	182.558	8.893	800	
700	138.428	7.264	140.934	7.313	143.440	7.366	145.947	7.422	148.454	7.480	150.961	7.542	153.468	7.606	155.976	7.674	158.484	7.745	160.993	7.818	163.501	7.895	166.010	7.974	168.519	8.057	700	
600	124.381	6.345	126.888	6.403	129.395	6.465	131.903	6.530	134.410	6.598	136.919	6.669	139.427	6.745	141.936	6.824	144.445	6.906	146.954	6.992	149.464	7.081	151.974	7.174	154.484	7.270	600	
500	110.337	5.452	112.845	5.521	115.353	5.595	117.862	5.673	120.371	5.755	122.880	5.841	125.390	5.932	127.900	6.026	130.410	6.125	132.921	6.228	135.432	6.335	137.943	6.447	140.454	6.562	500	
400	96.297	4.604	98.806	4.691	101.316	4.783	103.826	4.880	106.337	4.982	108.847	5.090	111.359	5.203	113.870	5.321	116.382	5.445	118.894	5.573	121.406	5.707	123.919	5.846	126.432	5.991	400	
360	90.682	4.286	93.192	4.382	95.703	4.484	98.214	4.592	100.725	4.706	103.237	4.826	105.749	4.951	108.261	5.082	110.773	5.219	113.286	5.362	115.799	5.511	118.312	5.665	120.825	5.826	360	100 (P)*
350	89.279	4.209	91.789	4.308	94.300	4.413	96.811	4.524	99.322	4.641	101.834	4.764	104.346	4.893	106.859	5.028	109.371	5.169	111.884	5.316	114.397	5.469	116.910	5.628	119.424	5.793	350	
300	82.263	3.845	84.775	3.961	87.286	4.083	89.799	4.213	92.311	4.349	94.824	4.493	97.337	4.643	99.850	4.801	102.363	4.965	104.876	5.136	107.390	5.314	109.904	5.500	112.417	5.692	300	
250	75.251	3.533	77.763	3.672	80.276	3.819	82.789	3.974	85.303	4.138	87.816	4.310	90.330	4.490	92.843	4.679	95.357	4.876	97.870	5.081	100.384	5.294	102.897	5.516	105.410	5.746	250	
230	72.447	3.430	74.960	3.580	77.473	3.740	79.986	3.909	82.500	4.087	85.014	4.274	87.527	4.469	90.041	4.674	92.554	4.888	95.068	5.111	97.581	5.343	100.094	5.584	102.606	5.834	230	80 (P)*
200	68.242	3.310	70.755	3.483	73.269	3.667	75.783	3.860	78.296	4.065	80.810	4.279	83.323	4.504	85.836	4.740	88.349	4.985	90.861	5.241	93.373	5.508	95.884	5.784	98.395	6.071	200	
170	64.038	3.252	66.552	3.455	69.065	3.670	71.579	3.898	74.092	4.138	76.604	4.390	79.116	4.654	81.627	4.931	84.137	5.219	86.647	5.519	89.156	5.832	91.663	6.156	94.169	6.493	170	
155	61.936	3.256	64.450	3.479	66.963	3.715	69.475	3.965	71.987	4.228	74.499	4.504	77.009	4.793	79.518	5.096	82.027	5.411	84.534	5.740	87.039	6.082	89.543	6.437	92.046	6.805	155	65 (P)*
125	57.730	3.375	60.241	3.650	62.752	3.942	65.260	4.251	67.768	4.575	70.274	4.916	72.778	5.273	75.279	5.647	77.779	6.036	80.276	6.441	82.770	6.863	85.262	7.300	87.750	7.753	125	
100	54.214	3.660	56.720	4.003	59.223	4.366	61.723	4.750	64.221	5.153	66.715	5.576	69.205	6.019	71.692	6.482	74.174	6.964	76.651	7.466	79.124	7.987	81.592	8.528	84.054	9.087	100	
90	52.800	3.856	55.301	4.235	57.799	4.638	60.292	5.062	62.782	5.508	65.267	5.977	67.748	6.467	70.223	6.978	72.693	7.511	75.157	8.065	77.614	8.640	80.065	9.236	82.509	9.852	90	50 (P)*
80	51.377	4.122	53.870	4.548	56.359	4.999	58.843	5.474	61.321	5.973	63.793	6.496	66.259	7.044	68.718	7.615	71.169	8.210	73.612	8.827	76.047	9.468	78.473	10.132	80.890	10.818	80	50 (H)**
70	49.936	4.490	52.417	4.974	54.893	5.486	57.361	6.024	59.821	6.590	62.273	7.183	64.715	7.803	67.149	8.448	69.572	9.120	71.984	9.817	74.385	10.539	76.774	11.286	79.151	12.057	70	
60	48.462	5.007	50.924	5.566	53.377	6.157	55.819	6.779	58.249	7.431	60.668	8.113	63.074	8.825	65.466	9.566	67.843	10.335	70.206	11.132	72.553	11.957	74.883	12.808	77.196	13.685	60	40 (P)*
55	47.703	5.345	50.151	5.951	52.586	6.591	55.009	7.264	57.417	7.969	59.811	8.706	62.190	9.474	64.552	10.272	66.896	11.100	69.223	11.958	71.530	12.843	73.818	13.757	76.086	14.697	55	
50	46.921	5.756	49.348	6.417	51.761	7.114	54.157	7.846	56.536	8.612	58.897	9.412	61.239	10.245	63.561	11.109	65.862	12.005	68.141	12.930	70.396	13.885	72.629	14.868	74.836	15.877	50	40 (H)**
45	46.103	6.260	48.502	6.987	50.883	7.751	53.243	8.553	55.581	9.391	57.897	10.264	60.190	11.171	62.457	12.111	64.699	13.083	66.913	14.086	69.099	15.117	71.256	16.177	73.384	17.264	45	35 (P)*
40	45.229	6.890	47.588	7.694	49.922	8.539	52.231	9.422	54.513	10.344	56.765	11.302	58.988	12.295	61.180	13.322	63.339	14.380	65.464	15.468							40	30 (H)**
35	44.261	7.689	46.561	8.586	48.828	9.526	51.062	10.507	53.260	11.526	55.422	12.582															35	
33	43.835	8.069	46.102	9.010	48.334	9.993	50.528	11.016	52.682	12.079																	33	30 (P)*
30	43.132	8.722	45.340	9.732	47.504	10.785																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 17 Degrees

Δ = 17°

R_O	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_C	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	381.128	27.770	383.628	27.773	386.129	27.777	388.629	27.781	391.130	27.787	393.631	27.793	396.132	27.800	398.633	27.808	401.135	27.817	403.636	27.827	406.137	27.837	408.639	27.849	411.141	27.861	2500	
2200	336.292	24.438	338.793	24.442	341.294	24.446	343.794	24.452	346.295	24.458	348.796	24.465	351.298	24.473	353.799	24.482	356.300	24.492	358.802	24.503	361.303	24.515	363.805	24.528	366.308	24.542	2200	
2000	306.402	22.218	308.903	22.221	311.404	22.226	313.905	22.232	316.406	22.239	318.907	22.247	321.408	22.256	323.909	22.266	326.411	22.277	328.913	22.289	331.415	22.302	333.917	22.316	336.419	22.332	2000	
1800	276.512	19.997	279.013	20.001	281.514	20.006	284.015	20.013	286.516	20.020	289.017	20.029	291.519	20.039	294.020	20.050	296.522	20.063	299.024	20.076	301.526	20.091	304.028	20.106	306.531	20.123	1800	
1500	231.677	16.666	234.178	16.671	236.679	16.677	239.180	16.685	241.681	16.694	244.183	16.705	246.684	16.717	249.186	16.730	251.689	16.745	254.191	16.761	256.693	16.779	259.196	16.797	261.699	16.818	1500	
1200	186.842	13.336	189.343	13.342	191.844	13.350	194.346	13.359	196.847	13.371	199.349	13.384	201.851	13.399	204.354	13.416	206.856	13.434	209.359	13.454	211.862	13.476	214.365	13.500	216.869	13.525	1200	
1000	156.932	11.116	159.453	11.123	161.955	11.133	164.456	11.145	166.958	11.158	169.461	11.174	171.963	11.192	174.466	11.212	176.969	11.234	179.472	11.258	181.976	11.284	184.480	11.313	186.984	11.344	1000	
900	142.007	10.006	144.508	10.015	147.010	10.025	149.512	10.038	152.014	10.053	154.516	10.071	157.019	10.091	159.522	10.113	162.026	10.137	164.530	10.165	167.034	10.194	169.538	10.225	172.043	10.259	900	
800	127.062	8.897	129.564	8.906	132.065	8.918	134.567	8.933	137.070	8.950	139.573	8.969	142.076	8.992	144.579	9.017	147.083	9.044	149.587	9.075	152.092	9.108	154.597	9.143	157.102	9.181	800	
700	112.118	7.788	114.619	7.799	117.121	7.812	119.623	7.829	122.126	7.848	124.629	7.871	127.133	7.896	129.637	7.925	132.141	7.957	134.646	7.991	137.151	8.029	139.656	8.070	142.162	8.113	700	100 (P)*
600	97.173	6.680	99.675	6.692	102.177	6.708	104.680	6.727	107.183	6.750	109.686	6.776	112.190	6.806	114.695	6.839	117.200	6.876	119.705	6.917	122.211	6.961	124.717	7.008	127.224	7.059	600	
500	82.228	5.572	84.730	5.587	87.233	5.606	89.736	5.629	92.240	5.656	94.744	5.688	97.249	5.724	99.754	5.764	102.260	5.808	104.767	5.857	107.273	5.909	109.781	5.966	112.288	6.027	500	
400	67.284	4.466	69.786	4.485	72.290	4.509	74.794	4.537	77.298	4.572	79.804	4.611	82.309	4.656	84.816	4.706	87.323	4.761	89.831	4.822	92.339	4.887	94.848	4.958	97.357	5.035	400	
360	61.306	4.025	63.809	4.045	66.313	4.071	68.817	4.104	71.322	4.142	73.828	4.186	76.334	4.235	78.842	4.291	81.349	4.352	83.858	4.419	86.367	4.492	88.876	4.572	91.386	4.656	360	
350	59.812	3.914	62.315	3.935	64.818	3.963	67.323	3.996	69.828	4.035	72.334	4.080	74.841	4.131	77.348	4.188	79.856	4.251	82.364	4.321	84.874	4.396	87.383	4.477	89.893	4.564	350	
300	52.340	3.364	54.843	3.388	57.348	3.420	59.853	3.458	62.359	3.504	64.865	3.557	67.373	3.616	69.881	3.683	72.390	3.757	74.900	3.837	77.410	3.925	79.921	4.020	82.432	4.121	300	80 (P)*
250	44.868	2.815	47.372	2.844	49.877	2.882	52.383	2.928	54.890	2.983	57.398	3.046	59.907	3.118	62.417	3.198	64.927	3.286	67.438	3.383	69.950	3.488	72.462	3.602	74.975	3.724	250	
230	41.880	2.596	44.384	2.628	46.889	2.669	49.396	2.719	51.903	2.779	54.412	2.847	56.921	2.925	59.432	3.012	61.942	3.108	64.454	3.214	66.966	3.328	69.479	3.451	71.993	3.584	230	
200	37.397	2.269	39.902	2.306	42.408	2.353	44.915	2.411	47.424	2.479	49.933	2.558	52.444	2.648	54.955	2.748	57.467	2.858	59.980	2.979	62.493	3.110	65.007	3.252	67.521	3.405	200	
170	32.914	1.944	35.420	1.987	37.927	2.043	40.436	2.111	42.945	2.192	45.456	2.284	47.968	2.390	50.480	2.507	52.993	2.637	55.507	2.779	58.022	2.934	60.536	3.101	63.052	3.280	170	65 (P)*
155	30.673	1.783	33.180	1.830	35.687	1.891	38.196	1.966	40.707	2.054	43.218	2.156	45.730	2.271	48.244	2.400	50.757	2.543	53.272	2.699	55.787	2.868	58.302	3.051	60.817	3.247	155	
125	26.192	1.464	28.699	1.523	31.208	1.599	33.719	1.691	36.231	1.801	38.744	1.927	41.258	2.070	43.772	2.230	46.287	2.406	48.803	2.599	51.318	2.809	53.834	3.035	56.348	3.278	125	
100	22.458	1.203	24.967	1.279	27.477	1.374	29.990	1.490	32.503	1.626	35.018	1.784	37.533	1.962	40.048	2.162	42.564	2.382	45.079	2.622	47.593	2.884	50.106	3.166	52.619	3.469	100	
90	20.964	1.105	23.474	1.187	25.986	1.292	28.499	1.420	31.013	1.572	33.528	1.747	36.044	1.945	38.559	2.167	41.074	2.411	43.588	2.678	46.101	2.968	48.612	3.281	51.121	3.616	90	50 (P)*
80	19.471	1.007	21.982	1.099	24.495	1.217	27.008	1.362	29.523	1.533	32.039	1.729	34.554	1.952	37.069	2.204	39.583	2.475	42.095	2.773	44.605	3.100	47.115	3.451	49.617	3.828	80	50 (H)**
70	17.979	0.913	20.490	1.018	23.001	1.153	25.519	1.318	28.034	1.513	30.549	1.738	33.064	1.992	35.577	2.275	38.088	2.588	40.597	2.930	43.102	3.301	45.604	3.700	48.101	4.128	70	
60	16.486	0.824	18.999	0.947	21.514	1.105	24.029	1.297	26.544	1.524	29.059	1.785	31.571	2.081	34.081	2.411	36.587	2.775	39.089	3.172	41.586	3.602	44.076	4.065	46.560	4.561	60	40 (P)*
55	15.741	0.783	18.254	0.917	20.769	1.089	23.284	1.298	25.799	1.546	28.312	1.831	30.823	2.153	33.330	2.512	35.832	2.907	38.328	3.339	40.818	3.807	43.299	4.310	45.773	4.849	55	
50	14.995	0.745	17.509	0.892	20.024	1.081	22.539	1.311	25.053	1.583	27.564	1.896	30.072	2.249	32.574	2.643	35.070	3.077	37.559	3.550	40.038	4.062	42.508	4.613	44.967	5.201	50	40 (H)**
45	14.249	0.710	16.764	0.874	19.279	1.083	21.794	1.339	24.306	1.640	26.814	1.987	29.317	2.379	31.812	2.815	34.300	3.294	36.777	3.817	39.242	4.382	41.695	4.989	44.133	5.637	45	35 (P)*
40	13.504	0.681	16.019	0.865	18.534	1.100	21.047	1.387	23.556	1.726	26.059	2.114	28.555	2.553	31.040	3.041	33.513	3.577	35.974	4.161	38.418	4.791	40.846	5.466	43.255	6.186	40	35 (H) 30 (P)**
35	12.759	0.659	15.275	0.869	17.789	1.138	20.298	1.463	22.802	1.850	25.296	2.292	27.779	2.791	30.248	3.344	32.701	3.951	35.135	4.610	37.548	5.321	39.937	6.081	42.301	6.889	35	
33	12.461	0.653	14.977	0.876	17.490	1.160	19.998	1.507	22.498	1.915	24.987	2.383	27.464	2.909	29.923	3.494	32.364	4.134	34.784	4.829	37.179	5.577	39.548	6.377	41.888	7.225	33	
30	12.015	0.648	14.529	0.893	17.040	1.205	19.545	1.586	22.038	2.033	24.518	2.545	26.980	3.120	29.422	3.758	31.840	4.456	34.232	5.212	36.594	6.024	38.923	6.889	41.218	7.806	30	30 (H)**
25	11.270	0.656	13.782	0.948	16.287	1.322	18.779	1.775	21.254	2.306	23.707	2.913	26.132	3.593	28.527	4.343	30.885	5.161	33.204	6.042	35.486	6.983	37.709	7.980	39.887	9.030	25	
23	10.972	0.666	13.482	0.983	15.983	1.388	18.467	1.879	20.930	2.453	23.365	3.108	25.768	3.840	28.133	4.646	30.456	5.522	32.732	6.463	34.956	7.465	37.125	8.524			23	25 (P)*
20	10.524	0.694	13.030	1.057	15.520	1.520	17.987	2.080	20.423	2.733	22.821	3.475	25.175	4.300	27.478	5.204	29.725	6.181	31.909	7.224							20	25 (H)**
15	9.772	0.793	12.259	1.272	14.711	1.879	17.116	2.606	19.462	3.445	21.737	4.386	23.932	5.418													15	20 (P)*
14	9.620	0.826	12.099	1.337	14.538	1.984	16.921	2.755	19.235	3.643	21.468	4.634															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 17 Degrees

$\Delta = 17°$

R_O	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	413.643	27.874	416.145	27.888	418.647	27.903	421.149	27.918	423.651	27.935	426.154	27.952	428.656	27.970	431.159	27.989	433.662	28.009	436.165	28.030	438.668	28.051	441.171	28.073	443.674	28.096	2500	
2200	368.810	24.557	371.312	24.573	373.814	24.589	376.317	24.607	378.819	24.626	381.322	24.645	383.825	24.666	386.328	24.688	388.831	24.710	391.334	24.733	393.838	24.758	396.341	24.783	398.845	24.810	2200	
2000	338.921	22.348	341.423	22.365	343.926	22.384	346.429	22.403	348.932	22.424	351.435	22.445	353.938	22.468	356.441	22.491	358.945	22.516	361.448	22.542	363.952	22.569	366.456	22.597	368.960	22.626	2000	
1800	309.033	20.142	311.536	20.161	314.039	20.181	316.542	20.203	319.045	20.226	321.548	20.250	324.052	20.275	326.555	20.301	329.059	20.329	331.563	20.357	334.067	20.387	336.571	20.418	339.076	20.450	1800	
1500	264.202	16.839	266.705	16.863	269.208	16.887	271.712	16.913	274.216	16.941	276.720	16.969	279.224	17.000	281.728	17.031	284.233	17.064	286.738	17.099	289.242	17.135	291.747	17.171	294.252	17.210	1500	
1200	219.373	11.552	221.877	13.582	224.381	13.612	226.885	13.645	229.390	13.679	231.895	13.715	234.400	13.753	236.905	13.792	239.411	13.833	241.916	13.876	244.422	13.921	246.928	13.968	249.435	14.016	1200	
1000	189.489	11.376	191.993	11.411	194.498	11.448	197.003	11.487	199.509	11.528	202.015	11.571	204.521	11.616	207.027	11.664	209.533	11.713	212.040	11.765	214.547	11.818	217.054	11.874	219.561	11.932	1000	
900	174.547	10.295	177.053	10.334	179.558	10.375	182.064	10.418	184.570	10.464	187.076	10.512	189.583	10.562	192.089	10.615	194.596	10.670	197.104	10.727	199.611	10.787	202.119	10.849	204.627	10.913	900	
800	159.607	9.222	162.113	9.266	164.619	9.312	167.125	9.360	169.632	9.412	172.139	9.466	174.646	9.522	177.154	9.582	179.661	9.643	182.170	9.708	184.678	9.775	187.186	9.845	189.695	9.917	800	
700	144.668	8.160	147.175	8.209	149.681	8.262	152.189	8.318	154.696	8.376	157.204	8.438	159.712	8.502	162.220	8.570	164.729	8.641	167.238	8.715	169.747	8.791	172.257	8.871	174.767	8.954	700	
600	129.731	7.113	132.238	7.171	134.746	7.233	137.254	7.298	139.763	7.366	142.271	7.438	144.781	7.513	147.290	7.592	149.800	7.675	152.310	7.761	154.820	7.850	157.331	7.943	159.842	8.039	600	
500	114.797	6.092	117.305	6.162	119.814	6.236	122.324	6.313	124.833	6.396	127.343	6.482	129.854	6.572	132.365	6.667	134.876	6.766	137.387	6.869	139.899	6.976	142.411	7.088	144.924	7.203	500	
400	99.867	5.116	102.377	5.203	104.887	5.295	107.398	5.393	109.910	5.495	112.422	5.603	114.934	5.716	117.447	5.835	119.959	5.958	122.473	6.087	124.986	6.221	127.500	6.360	130.014	6.505	400	
360	93.897	4.747	96.407	4.843	98.919	4.946	101.431	5.054	103.943	5.168	106.456	5.288	108.969	5.413	111.482	5.545	113.996	5.682	116.510	5.825	119.024	5.974	121.538	6.128	124.053	6.289	360	100 (P)*
350	92.404	4.657	94.915	4.756	97.427	4.862	99.939	4.973	102.452	5.090	104.964	5.213	107.478	5.343	109.991	5.478	112.505	5.619	115.019	5.766	117.533	5.919	120.048	6.078	122.563	6.243	350	
300	84.944	4.230	87.457	4.346	89.970	4.469	92.483	4.598	94.996	4.735	97.510	4.878	100.025	5.029	102.539	5.187	105.054	5.351	107.569	5.523	110.084	5.701	112.599	5.887	115.114	6.079	300	
250	77.488	3.854	80.002	3.993	82.516	4.140	85.030	4.296	87.545	4.459	90.060	4.632	92.575	4.812	95.090	5.001	97.606	5.198	100.121	5.404	102.636	5.618	105.152	5.840	107.667	6.070	250	
230	74.506	3.726	77.021	3.876	79.535	4.036	82.050	4.205	84.565	4.383	87.081	4.570	89.596	4.766	92.111	4.972	94.627	5.186	97.142	5.409	99.657	5.641	102.172	5.883	104.687	6.133	230	80 (P)*
200	70.036	3.568	72.551	3.741	75.066	3.924	77.581	4.119	80.097	4.323	82.612	4.538	85.128	4.763	87.643	4.999	90.158	5.245	92.672	5.501	95.186	5.768	97.700	6.045	100.213	6.332	200	
170	65.567	3.471	68.082	3.675	70.598	3.890	73.113	4.118	75.628	4.359	78.143	4.611	80.657	4.876	83.171	5.152	85.684	5.441	88.196	5.742	90.707	6.054	93.217	6.379	95.727	6.716	170	
155	63.333	3.457	65.848	3.680	68.363	3.917	70.878	4.166	73.392	4.429	75.906	4.706	78.419	4.996	80.931	5.298	83.442	5.615	85.952	5.944	88.460	6.286	90.968	6.642	93.473	7.010	155	65 (P)*
125	58.863	3.537	61.377	3.813	63.889	4.106	66.401	4.414	68.911	4.739	71.420	5.081	73.927	5.438	76.432	5.812	78.935	6.202	81.436	6.608	83.934	7.030	86.429	7.467	88.922	7.921	125	
100	55.129	3.792	57.637	4.135	60.144	4.499	62.648	4.882	65.148	5.286	67.646	5.710	70.141	6.154	72.631	6.617	75.118	7.100	77.600	7.602	80.077	8.124	82.549	8.665	85.017	9.225	100	
90	53.628	3.974	56.133	4.355	58.634	4.758	61.131	5.182	63.625	5.629	66.114	6.098	68.599	6.589	71.079	7.101	73.553	7.634	76.022	8.189	78.484	8.765	80.941	9.361	83.390	9.979	90	50 (P)*
80	52.119	4.229	54.616	4.655	57.109	5.106	59.597	5.582	62.080	6.082	64.556	6.606	67.027	7.154	69.491	7.726	71.947	8.321	74.396	8.940	76.837	9.581	79.269	10.246	81.692	10.933	80	50 (H)**
70	50.593	4.585	53.079	5.069	55.559	5.581	58.032	6.121	60.497	6.687	62.954	7.281	65.402	7.901	67.841	8.548	70.270	9.220	72.688	9.918	75.095	10.641	77.491	11.389	79.875	12.161	70	
60	49.036	5.090	51.503	5.650	53.960	6.241	56.408	6.863	58.844	7.516	61.269	8.199	63.681	8.912	66.079	9.654	68.464	10.424	70.834	11.222	73.188	12.048	75.526	12.900	77.847	13.779	60	40 (P)*
55	48.236	5.422	50.689	6.029	53.130	6.669	55.558	7.343	57.973	8.049	60.373	8.786	62.759	9.555	65.128	10.355	67.480	11.184	69.814	12.042	72.129	12.929	74.425	13.844	76.701	14.785	55	
50	47.413	5.826	49.846	6.488	52.265	7.186	54.667	7.919	57.053	8.687	59.421	9.488	61.771	10.321	64.100	11.187	66.409	12.083	68.696	13.010	70.960	13.966	73.201	14.950	75.417	15.961	50	40 (H)**
45	46.556	6.325	48.961	7.052	51.348	7.818	53.715	8.621	56.061	9.460	58.385	10.334	60.685	11.242	62.961	12.184	65.211	13.157	67.434	14.160	69.630	15.194	71.796	16.255	73.933	17.343	45	35 (P)*
40	45.643	6.949	48.008	7.754	50.350	8.600	52.667	9.485	54.957	10.408	57.218	11.367	59.450	12.362	51.650	13.389	63.819	14.449	65.954	15.538							40	30 (H)**
35	44.638	7.743	46.945	8.642	49.221	9.583	51.463	10.565	53.671	11.585	55.841	12.643															35	
33	44.197	8.121	46.473	9.063	48.713	10.047	50.916	11.072	53.080	12.136																	33	30 (P)*
30	43.474	8.771	45.690	9.782	47.864	10.836																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P : Plain & Rolling Terrian **H : Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 18°$

Deviation Angle = 18 Degrees

R_C	$L_S = 15$ metres		$L_S = 20$ metres		$L_S = 25$ metres		$L_S = 30$ metres		$L_S = 35$ metres		$L_S = 40$ metres		$L_S = 45$ metres		$L_S = 50$ metres		$L_S = 55$ metres		$L_S = 60$ metres		$L_S = 65$ metres		$L_S = 70$ metres		$L_S = 75$ metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre			
2500	403.461	31.167	405.962	31.170	408.462	31.174	410.963	31.179	413.464	31.185	415.965	31.191	418.466	31.198	420.967	31.206	423.469	31.215	425.970	31.225	428.471	31.235	430.973	31.247	433.475	31.259	2500	
2200	355.946	27.428	358.447	27.432	360.947	27.436	363.448	27.441	365.949	27.448	368.450	27.455	370.951	27.463	373.453	27.472	375.954	27.482	378.456	27.493	380.958	27.505	383.460	27.518	385.962	27.532	2200	
2000	324.269	24.936	326.770	24.939	329.271	24.944	331.771	24.950	334.273	24.957	336.774	24.965	339.275	24.974	341.777	24.984	344.278	24.995	346.780	25.007	349.282	25.020	351.784	25.034	354.287	25.050	2000	
1800	292.593	22.443	295.093	22.447	297.594	22.452	300.095	22.459	302.596	22.467	305.098	22.475	307.599	22.485	310.101	22.496	312.603	22.509	315.105	22.522	317.607	22.537	320.109	22.553	322.612	22.570	1800	
1500	245.077	18.705	247.578	18.709	250.079	18.716	252.580	18.723	255.082	18.733	257.583	18.743	260.085	18.755	262.587	18.768	265.089	18.783	267.592	18.800	270.094	18.817	272.597	18.836	275.100	18.856	1500	
1200	197.562	14.967	200.063	14.973	202.565	14.980	205.066	14.990	207.568	15.001	210.070	15.015	212.572	15.030	215.075	15.047	217.577	15.065	220.080	15.085	222.584	15.107	225.087	15.131	227.591	15.156	1200	
1000	165.886	12.475	168.387	12.482	170.888	12.492	173.390	12.504	175.892	12.517	178.395	12.533	180.897	12.551	183.400	12.571	185.904	12.593	188.407	12.617	190.911	12.644	193.415	12.672	195.920	12.703	1000	
900	150.047	11.229	152.549	11.238	155.050	11.248	157.552	11.261	160.055	11.276	162.557	11.294	165.060	11.314	167.564	11.336	170.067	11.361	172.571	11.388	175.075	11.417	177.580	11.448	180.085	11.483	900	
800	134.209	9.984	136.711	9.993	139.212	10.005	141.715	10.020	144.217	10.037	146.720	10.057	149.224	10.079	151.727	10.104	154.231	10.132	156.736	10.162	159.240	10.195	161.746	10.231	164.251	10.269	800	
700	118.371	8.740	120.873	8.750	123.375	8.763	125.877	8.780	128.380	8.800	130.884	8.822	133.387	8.848	135.891	8.876	138.396	8.908	140.901	8.943	143.406	8.980	145.912	9.021	148.418	9.065	700	100 (P)*
600	102.533	7.495	105.035	7.508	107.537	7.523	110.040	7.542	112.544	7.565	115.047	7.592	117.552	7.622	120.057	7.655	122.562	7.692	125.068	7.732	127.574	7.776	130.080	7.824	132.588	7.875	600	
500	86.695	6.252	89.197	6.267	91.700	6.285	94.204	6.309	96.708	6.336	99.212	6.368	101.717	6.404	104.223	6.444	106.729	6.488	109.236	6.537	111.743	6.589	114.251	6.646	116.759	6.707	500	
400	70.857	5.010	73.360	5.029	75.864	5.052	78.368	5.081	80.873	5.115	83.378	5.155	85.885	5.200	88.392	5.250	90.899	5.305	93.407	5.366	95.916	5.432	98.426	5.503	100.935	5.579	400	
360	64.522	4.514	67.025	4.534	69.529	4.561	72.034	4.593	74.539	4.631	77.046	4.675	79.553	4.725	82.060	4.781	84.568	4.842	87.077	4.909	89.587	4.982	92.097	5.062	94.608	5.146	360	
350	62.939	4.390	65.442	4.411	67.946	4.438	70.451	4.471	72.956	4.510	75.462	4.556	77.970	4.607	80.477	4.664	82.986	4.728	85.495	4.797	88.005	4.872	90.515	4.953	93.026	5.041	350	80 (P)*
300	55.020	3.771	57.524	3.796	60.028	3.828	62.534	3.866	65.040	3.912	67.548	3.965	70.056	4.024	72.564	4.091	75.074	4.165	77.584	4.246	80.095	4.334	82.607	4.428	85.119	4.530	300	
250	47.102	3.154	49.606	3.184	52.112	3.222	54.618	3.268	57.126	3.323	59.634	3.386	62.143	3.458	64.654	3.538	67.165	3.627	69.677	3.724	72.189	3.829	74.702	3.943	77.216	4.065	250	
230	43.935	2.908	46.439	2.940	48.945	2.982	51.452	3.032	53.960	3.092	56.469	3.160	58.979	3.238	61.490	3.325	64.002	3.422	66.515	3.527	69.028	3.641	71.542	3.765	74.056	3.898	230	
200	39.184	2.541	41.689	2.577	44.196	2.625	46.704	2.683	49.213	2.751	51.723	2.830	54.234	2.920	56.746	3.020	59.259	3.131	61.773	3.252	64.288	3.383	66.803	3.526	69.318	3.678	200	
170	34.434	2.175	36.940	2.218	39.447	2.274	41.956	2.342	44.467	2.423	46.978	2.516	49.491	2.621	52.004	2.739	54.519	2.869	57.034	3.011	59.550	3.166	62.066	3.333	64.583	3.513	170	65 (P)*
155	32.059	1.993	34.565	2.041	37.073	2.102	39.583	2.177	42.094	2.265	44.607	2.367	47.120	2.483	49.634	2.612	52.149	2.755	54.665	2.911	57.182	3.080	59.698	3.263	62.216	3.460	155	
125	27.309	1.634	29.817	1.693	32.327	1.769	34.838	1.862	37.351	1.971	39.865	2.098	42.381	2.241	44.897	2.401	47.413	2.577	49.930	2.771	52.447	2.981	54.965	3.207	57.482	3.450	125	
100	23.352	1.341	25.861	1.413	28.373	1.510	30.887	1.626	33.401	1.765	35.917	1.931	38.434	2.099	40.951	2.299	43.468	2.519	45.985	2.760	48.502	3.022	51.018	3.305	53.533	3.608	100	
90	21.769	1.227	24.280	1.309	26.792	1.415	29.307	1.543	31.822	1.695	34.339	1.871	36.856	2.069	39.373	2.290	41.890	2.535	44.407	2.803	46.922	3.093	49.436	3.406	51.949	3.742	90	50 (P)*
80	20.187	1.116	22.699	1.208	25.212	1.327	27.727	1.471	30.244	1.642	32.761	1.839	35.278	2.062	37.795	2.311	40.311	2.586	42.826	2.886	45.339	3.212	47.850	3.564	50.358	3.940	80	50 (H)**
70	18.605	1.008	21.118	1.118	23.632	1.249	26.149	1.414	28.666	1.609	31.183	1.834	33.700	2.088	36.216	2.372	38.730	2.686	41.241	3.028	43.750	3.399	46.255	3.799	48.756	4.228	70	
60	17.024	0.906	19.538	1.029	22.054	1.187	24.571	1.379	27.088	1.607	29.604	1.868	32.120	2.165	34.632	2.495	37.142	2.859	39.647	3.257	42.148	3.688	44.642	4.152	47.130	4.648	60	40 (P)*
55	16.233	0.858	18.748	0.992	21.264	1.164	23.782	1.374	26.299	1.622	28.814	1.907	31.328	2.230	33.838	2.589	36.343	2.985	38.843	3.418	41.337	3.886	43.823	4.390	46.301	4.929	55	
50	15.443	0.813	17.959	0.960	20.476	1.149	22.993	1.380	25.509	1.652	28.023	1.966	30.534	2.320	33.039	2.714	35.539	3.148	38.032	3.622	40.516	4.135	42.991	4.686	45.455	5.273	50	40 (H)**
45	14.653	0.772	17.169	0.935	19.687	1.145	22.203	1.401	24.718	1.703	27.229	2.050	29.735	2.442	32.235	2.879	34.726	3.359	37.208	3.883	39.679	4.449	42.137	5.057	44.581	5.705	45	35 (P)*
40	13.864	0.736	16.380	0.920	18.898	1.155	21.413	1.443	23.925	1.782	26.431	2.171	28.930	2.610	31.420	3.099	33.898	3.636	36.364	4.220	38.814	4.851	41.248	5.527	43.663	6.248	40	35 (H) 30 (P)*
35	13.074	0.707	15.592	0.917	18.108	1.166	20.621	1.514	23.128	1.900	25.626	2.342	28.113	2.841	30.587	3.395	33.045	4.003	35.485	4.663	37.904	5.375	40.300	6.136	42.672	6.945	35	
33	12.759	0.698	15.276	0.921	17.791	1.206	20.303	1.553	22.806	1.962	25.300	2.430	27.781	2.957	30.246	3.543	32.692	4.184	35.118	4.880	37.520	5.629	39.896	6.430	42.244	7.279	33	
30	12.285	0.690	14.802	0.934	17.316	1.247	19.824	1.628	22.321	2.076	24.805	2.589	27.273	3.165	29.720	3.804	32.145	4.502	34.543	5.259	36.912	6.072	39.249	6.939	41.552	7.857	30	30 (H)**
25	11.496	0.690	14.011	0.983	16.520	1.357	19.016	1.811	21.495	2.343	23.953	2.951	26.385	3.632	28.786	4.383	31.152	5.201	33.479	6.083	35.763	7.026	38.000	8.025	40.187	9.076	25	
23	11.181	0.698	13.694	1.015	16.198	1.421	18.687	1.913	21.155	2.488	23.596	3.143	26.005	3.877	28.378	4.683	30.708	5.560	32.992	6.503	35.225	7.506	37.404	8.566			23	25 (P)*
20	10.707	0.722	13.216	1.086	15.710	1.549	18.182	2.110	20.624	2.764	23.029	3.506	25.390	4.333	27.701	5.238	29.956	6.216	32.150	7.261							20	25 (H)**
15	9.912	0.814	12.403	1.294	14.860	1.902	17.272	2.630	19.625	3.469	21.908	4.412	24.112	5.446													15	20 (P)*
14	9.751	0.846	12.235	1.358	14.679	2.005	17.069	2.778	19.391	3.667	21.633	4.659															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 18 Degrees

△=18°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	435.977	31.272	438.479	31.286	440.981	31.300	443.484	31.316	445.986	31.333	448.489	31.350	450.992	31.368	453.495	31.387	455.998	31.407	458.501	31.427	461.004	31.449	463.507	31.471	466.011	31.494	2500	
2200	388.464	27.547	390.967	27.563	393.469	27.579	395.972	27.597	398.475	27.616	400.978	27.635	403.480	27.656	405.984	27.678	408.487	27.700	410.990	27.724	413.494	27.748	415.998	27.774	418.502	27.800	2200	
2000	356.789	25.066	359.292	25.083	361.794	25.102	364.297	25.121	366.801	25.142	369.304	25.164	371.807	25.186	374.311	25.210	376.814	25.235	379.318	25.260	381.822	25.287	384.326	25.315	386.830	25.344	2000	
1800	325.115	22.588	327.617	22.607	330.120	22.628	332.624	22.649	335.127	22.672	337.631	22.696	340.134	22.721	342.638	22.748	345.142	22.775	347.646	22.804	350.151	22.834	352.655	22.865	355.160	22.897	1800	
1500	277.604	18.878	280.107	18.901	282.611	18.926	285.115	18.952	287.619	18.979	290.123	19.008	292.627	19.039	295.132	19.070	297.636	19.103	300.142	19.138	302.647	19.174	305.152	19.211	307.657	19.250	1500	
1200	230.095	15.184	232.599	15.213	235.104	15.243	237.608	15.276	240.113	15.310	242.618	15.346	245.124	15.384	247.629	15.424	250.135	15.465	252.641	15.508	255.148	15.552	257.654	15.599	260.161	15.647	1200	
1000	198.424	12.735	200.929	12.770	203.435	12.807	205.940	12.846	208.446	12.887	210.952	12.930	213.459	12.976	215.965	13.023	218.472	13.073	220.979	13.125	223.487	13.178	225.994	13.234	228.502	13.292	1000	
900	182.590	11.519	185.096	11.558	187.601	11.599	190.108	11.642	192.614	11.687	195.121	11.736	197.628	11.786	200.135	11.839	202.643	11.894	205.150	11.951	207.658	12.011	210.167	12.073	212.675	12.137	900	
800	166.757	10.310	169.263	10.353	171.769	10.399	174.276	10.448	176.783	10.500	179.291	10.554	181.799	10.610	184.307	10.670	186.815	10.731	189.324	10.796	191.832	10.863	194.342	10.933	196.851	11.006	800	
700	150.925	9.111	153.432	9.161	155.939	9.214	158.447	9.270	160.955	9.328	163.463	9.390	165.972	9.455	168.481	9.523	170.990	9.594	173.500	9.667	176.010	9.744	178.520	9.824	181.030	9.907	700	
600	135.095	7.929	137.603	7.987	140.111	8.049	142.620	8.114	145.129	8.182	147.638	8.254	150.148	8.330	152.658	8.409	155.169	8.491	157.680	8.578	160.191	8.667	162.702	8.760	165.214	8.857	600	
500	119.268	6.773	121.777	6.842	124.287	6.916	126.797	6.994	129.307	7.076	131.818	7.163	134.330	7.253	136.841	7.348	139.353	7.447	141.866	7.550	144.378	7.658	146.892	7.770	149.405	7.885	500	
400	103.446	5.661	105.957	5.748	108.468	5.840	110.980	5.937	113.493	6.040	116.005	6.148	118.519	6.261	121.032	6.380	123.546	6.504	126.060	6.633	128.575	6.767	131.090	6.906	133.605	7.051	400	
360	97.119	5.237	99.631	5.334	102.143	5.436	104.656	5.544	107.169	5.658	109.683	5.779	112.197	5.905	114.712	6.036	117.227	6.173	119.742	6.316	122.257	6.466	124.773	6.621	127.289	6.781	360	100 (P)*
350	93.538	5.134	96.050	5.233	100.562	5.339	103.075	5.450	105.589	5.567	108.103	5.691	110.617	5.820	113.132	5.956	115.647	6.097	118.162	6.244	120.678	6.397	123.194	6.557	125.710	6.722	350	
300	87.632	4.639	90.146	4.755	92.660	4.878	95.174	5.008	97.689	5.144	100.204	5.288	102.720	5.439	105.235	5.597	107.752	5.762	110.268	5.933	112.785	6.112	115.302	6.298	117.819	6.490	300	
250	79.731	4.195	82.246	4.334	84.761	4.482	87.277	4.637	89.793	4.801	92.310	4.974	94.826	5.155	97.343	5.344	99.860	5.541	102.378	5.747	104.895	5.961	107.412	6.184	109.929	6.415	250	
230	76.572	4.040	79.087	4.191	81.603	4.351	84.119	4.520	86.636	4.698	89.153	4.885	91.670	5.082	94.187	5.287	96.705	5.502	99.222	5.725	101.739	5.958	104.256	6.200	106.773	6.450	230	80 (P)*
200	71.834	3.841	74.351	4.015	76.868	4.199	79.385	4.393	81.902	4.598	84.419	4.813	86.937	5.038	89.454	5.274	91.971	5.521	94.488	5.777	97.004	6.044	99.520	6.322	102.036	6.609	200	
170	67.100	3.704	69.617	3.908	72.134	4.124	74.651	4.352	77.168	4.593	79.685	4.846	82.202	5.111	84.718	5.388	87.234	5.677	89.748	5.978	92.262	6.291	94.776	6.616	97.288	6.954	170	
155	64.733	3.670	67.250	3.893	69.767	4.130	72.284	4.380	74.801	4.644	77.317	4.921	79.832	5.211	82.347	5.514	84.861	5.830	87.374	6.160	89.885	6.503	92.396	6.859	94.905	7.228	155	
125	59.999	3.710	62.515	3.987	65.030	4.279	67.544	4.588	70.057	4.914	72.569	5.256	75.079	5.614	77.588	5.988	80.094	6.378	82.598	6.785	85.100	7.207	87.599	7.645	90.096	8.099	125	
100	56.046	3.931	58.558	4.275	61.067	4.639	63.574	5.023	66.079	5.428	68.580	5.852	71.078	6.296	73.573	6.760	76.064	7.244	78.550	7.747	81.032	8.269	83.509	8.811	85.982	9.372	100	
90	54.459	4.101	56.966	4.482	59.471	4.885	61.972	5.310	64.470	5.758	66.963	6.227	69.452	6.719	71.937	7.231	74.416	7.766	76.889	8.321	79.357	8.898	81.818	9.495	84.273	10.113	90	50 (P)*
80	52.863	4.342	55.354	4.769	57.861	5.221	60.353	5.697	62.840	6.198	65.322	6.722	67.797	7.271	70.266	7.844	72.727	8.440	75.182	9.059	77.628	9.702	80.066	10.367	82.495	11.055	80	50 (H)**
70	51.252	4.685	53.742	5.170	56.227	5.683	58.704	6.223	61.174	6.791	63.637	7.385	66.090	8.006	68.535	8.653	70.970	9.327	73.394	10.025	75.808	10.750	78.210	11.498	80.601	12.272	70	
60	49.611	5.177	52.083	5.738	54.546	6.330	56.999	6.953	59.441	7.607	61.871	8.291	64.290	9.005	66.695	9.747	69.086	10.519	71.463	11.318	73.824	12.145	76.170	12.998	78.498	13.878	60	40 (P)*
55	48.770	5.503	51.228	6.111	53.674	6.752	56.109	7.426	58.530	8.133	60.937	8.872	63.329	9.642	65.705	10.443	68.064	11.273	70.406	12.132	72.729	13.020	75.033	13.936	77.317	14.879	55	
50	47.907	5.901	50.345	6.564	52.770	7.263	55.179	7.997	57.572	8.765	59.947	9.567	62.304	10.402	64.641	11.269	66.957	12.167	69.253	13.095	71.525	14.052	73.775	15.037	76.000	16.050	50	40 (H)**
45	47.009	6.394	49.421	7.122	51.815	7.889	54.189	8.693	56.542	9.533	58.874	10.408	61.182	11.318	63.466	12.261	65.725	13.235	67.957	14.240	70.161	15.274	72.337	16.339	74.484	17.426	45	35 (P)*
40	46.057	7.012	48.430	7.819	50.780	8.665	53.104	9.552	55.402	10.476	57.672	11.436	59.912	12.432	62.122	13.461	64.300	14.522	66.445	15.613							40	30 (H)**
35	45.016	7.800	47.331	8.700	49.615	9.643	51.866	10.626	54.082	11.648	56.262	12.707															35	
33	44.360	8.177	46.844	9.119	49.093	10.105	51.306	11.131	53.479	12.196																	33	30 (P)*
30	43.817	8.823	46.042	9.836	48.225	10.891																					30	30 (H)**
25																											25	25 (H)**
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 19 Degrees

$\Delta = 19°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	t_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	425.857	34.768	428.357	34.771	430.858	34.774	433.359	34.779	435.860	34.785	438.361	34.791	440.862	34.798	443.363	34.806	445.865	34.815	448.366	34.825	450.868	34.835	453.370	34.847	455.872	34.859	2500	
2200	375.654	30.396	378.155	30.600	380.656	30.604	383.156	30.609	385.657	30.616	388.158	30.623	390.660	30.631	393.161	30.640	395.663	30.650	398.165	30.661	400.667	30.673	403.169	30.686	405.671	30.700	2200	
2000	342.186	27.816	344.686	27.820	347.187	27.824	349.688	27.830	352.189	27.837	354.691	27.845	357.192	27.854	359.694	27.864	362.195	27.875	364.697	27.887	367.199	27.900	369.702	27.915	372.204	27.930	2000	
1800	308.717	25.035	311.218	25.039	313.719	25.044	316.220	25.051	318.721	25.059	321.223	25.068	323.724	25.077	326.226	25.089	328.728	25.101	331.230	25.114	333.733	25.129	336.235	25.145	338.738	25.162	1800	
1500	258.515	20.865	261.016	20.870	263.517	20.876	266.018	20.884	268.519	20.893	271.021	20.903	273.523	20.915	276.025	20.928	278.528	20.943	281.030	20.960	283.533	20.977	286.036	20.996	288.539	21.017	1500	
1200	208.312	16.695	210.813	16.701	213.315	16.709	215.816	16.718	218.318	16.730	220.820	16.743	223.322	16.758	225.825	16.775	228.328	16.793	230.831	16.813	233.335	16.835	235.838	16.859	238.342	16.885	1200	
1000	174.844	13.915	177.345	13.922	179.847	13.932	182.349	13.944	184.851	13.957	187.353	13.973	189.856	13.991	192.359	14.011	194.863	14.033	197.367	14.058	199.871	14.084	202.375	14.113	204.880	14.143	1000	
900	158.110	12.526	160.611	12.534	163.113	12.544	165.615	12.557	168.118	12.573	170.620	12.590	173.123	12.610	175.627	12.632	178.131	12.657	180.635	12.684	183.140	12.713	185.644	12.745	188.150	12.779	900	
800	141.376	11.136	143.877	11.146	146.379	11.157	148.882	11.172	151.384	11.189	153.888	11.209	156.391	11.231	158.895	11.256	161.399	11.284	163.904	11.314	166.409	11.347	168.914	11.383	171.420	11.421	800	
700	124.642	9.748	127.144	9.758	129.646	9.771	132.148	9.788	134.652	9.808	137.155	9.830	139.659	9.856	142.164	9.885	144.668	9.916	147.174	9.951	149.679	9.989	152.186	10.030	154.692	10.073	700	100 (P)*
600	107.908	8.359	110.410	8.372	112.913	8.387	115.416	8.407	117.919	8.429	120.423	8.456	122.928	8.486	125.433	8.519	127.939	8.556	130.445	8.597	132.951	8.641	135.458	8.688	137.966	8.739	600	
500	91.174	6.972	93.677	6.987	96.180	7.005	98.683	7.029	101.188	7.056	103.692	7.088	106.198	7.124	108.704	7.164	111.211	7.208	113.718	7.257	116.226	7.310	118.734	7.367	121.243	7.428	500	
400	74.441	5.586	76.944	5.604	79.447	5.628	81.952	5.657	84.457	5.692	86.963	5.731	89.470	5.776	91.977	5.826	94.485	5.882	96.994	5.942	99.503	6.008	102.013	6.080	104.524	6.156	400	
360	67.748	5.032	70.251	5.053	72.755	5.079	75.260	5.112	77.766	5.150	80.272	5.194	82.780	5.244	85.288	5.299	87.797	5.361	90.306	5.428	92.816	5.501	95.327	5.581	97.839	5.666	360	
350	66.074	4.894	68.578	4.915	71.082	4.942	73.587	4.976	76.093	5.015	78.600	5.060	81.107	5.111	83.615	5.169	86.124	5.232	88.634	5.301	91.145	5.377	93.656	5.458	96.168	5.546	350	
300	57.708	4.203	60.212	4.228	62.717	4.260	65.222	4.298	67.729	4.344	70.237	4.397	72.746	4.457	75.255	4.524	77.765	4.597	80.276	4.678	82.788	4.767	85.301	4.861	87.814	4.963	300	80 (P)*
250	49.342	3.514	51.846	3.544	54.352	3.582	56.859	3.628	59.367	3.683	61.876	3.747	64.386	3.818	66.897	3.899	69.409	3.987	71.922	4.084	74.435	4.190	76.949	4.304	79.464	4.426	250	
230	45.995	3.240	48.500	3.272	51.006	3.313	53.514	3.364	56.023	3.423	58.532	3.492	61.043	3.570	63.555	3.657	66.067	3.754	68.581	3.859	71.095	3.974	73.610	4.098	76.126	4.230	230	
200	40.976	2.829	43.482	2.866	45.989	2.913	48.497	2.971	51.007	3.040	53.518	3.119	56.030	3.209	58.543	3.309	61.057	3.420	63.571	3.541	66.087	3.673	68.603	3.815	71.120	3.968	200	
170	35.957	2.420	38.463	2.463	40.972	2.519	43.481	2.588	45.992	2.668	48.505	2.761	51.018	2.867	53.533	2.985	56.048	3.115	58.565	3.258	61.082	3.413	63.600	3.580	66.118	3.759	170	65 (P)*
155	33.448	2.217	35.955	2.264	38.463	2.326	40.974	2.401	43.486	2.489	45.999	2.591	48.513	2.707	51.029	2.836	53.545	2.979	56.062	3.135	58.580	3.305	61.099	3.488	63.618	3.685	155	
125	28.429	1.814	30.938	1.873	33.449	1.949	35.961	2.047	38.475	2.152	40.990	2.278	43.506	2.422	46.024	2.582	48.542	2.759	51.061	2.952	53.580	3.163	56.099	3.390	58.618	3.633	125	
100	24.249	1.486	26.759	1.559	29.271	1.654	31.786	1.770	34.302	1.908	36.819	2.067	39.337	2.244	41.856	2.444	44.375	2.665	46.895	2.907	49.414	3.169	51.932	3.452	54.449	3.755	100	
90	22.577	1.357	25.088	1.439	27.601	1.545	30.117	1.674	32.634	1.826	35.152	2.001	37.671	2.200	40.190	2.422	42.709	2.667	45.228	2.935	47.746	3.225	50.263	3.539	52.778	3.876	90	50 (P)*
80	20.905	1.231	23.417	1.324	25.932	1.442	28.448	1.587	30.966	1.758	33.485	1.955	36.004	2.179	38.523	2.428	41.042	2.703	43.560	3.004	46.076	3.330	48.589	3.682	51.101	4.060	80	50 (H)**
70	19.234	1.109	21.747	1.215	24.263	1.350	26.781	1.516	29.299	1.711	31.819	1.936	34.338	2.191	36.856	2.475	39.375	2.789	41.887	3.132	44.399	3.504	46.908	3.904	49.413	4.334	70	
60	17.563	0.995	20.078	1.116	22.595	1.274	25.114	1.467	27.633	1.694	30.152	1.956	32.670	2.253	35.185	2.584	37.698	2.948	40.207	3.347	42.711	3.778	45.210	4.243	47.702	4.740	60	40 (P)*
55	16.728	0.938	19.243	1.072	21.761	1.244	24.281	1.454	26.800	1.702	29.318	1.988	31.834	2.311	34.347	2.671	36.856	3.068	39.360	3.501	41.858	3.970	44.349	4.475	46.832	5.014	55	
50	15.893	0.885	18.410	1.033	20.928	1.222	23.447	1.453	25.966	1.726	28.483	2.039	30.996	2.394	33.506	2.789	36.009	3.224	38.506	3.698	40.995	4.212	43.475	4.764	45.944	5.354	50	40 (H)**
45	15.058	0.837	17.576	1.001	20.095	1.211	22.614	1.467	25.131	1.770	27.646	2.117	30.155	2.510	32.659	2.947	35.154	3.428	37.640	3.952	40.116	4.519	42.579	5.128	45.029	5.777	45	35 (P)*
40	14.224	0.794	16.742	0.978	19.262	1.214	21.780	1.502	24.295	1.841	26.805	2.231	29.307	2.671	31.801	3.160	34.285	3.698	36.755	4.283	39.211	4.915	41.650	5.592	44.072	6.314	40	35 (H) 30 (P)*
35	13.390	0.758	15.909	0.968	18.428	1.238	20.944	1.566	23.454	1.952	25.956	2.396	28.448	2.895	30.927	3.450	33.390	4.059	35.836	4.720	38.261	5.432	40.664	6.194	43.043	7.005	35	
33	13.057	0.746	15.576	0.969	18.094	1.255	20.608	1.603	23.116	2.011	25.614	2.481	28.099	3.009	30.569	3.595	33.021	4.237	35.453	4.934	37.862	5.684	40.245	6.486	42.600	7.337	33	
30	12.557	0.733	15.076	0.978	17.593	1.292	20.103	1.673	22.605	2.121	25.094	2.635	27.566	3.212	30.019	3.852	32.450	4.551	34.855	5.309	37.231	6.124	39.576	6.991	41.887	7.911	30	30 (H)**
25	11.724	0.727	14.241	1.020	16.753	1.394	19.253	1.849	21.737	2.382	24.201	2.990	26.638	3.672	29.046	4.425	31.419	5.244	33.754	6.128	36.046	7.071	38.292	8.072	40.489	9.125	25	
23	11.390	0.732	13.907	1.050	16.414	1.456	18.907	1.948	21.380	2.524	23.827	3.181	26.243	3.915	28.623	4.723	30.961	5.601	33.253	6.545	35.495	7.550	37.683	8.611			23	25 (P)*
20	10.890	0.751	13.402	1.116	15.901	1.580	18.377	2.141	20.825	2.796	23.237	3.540	25.605	4.367	27.924	5.274	30.188	6.253	32.391	7.300							20	25 (H)**
15	10.052	0.837	12.547	1.317	15.010	1.926	17.428	2.655	19.788	3.496	22.080	4.439	24.293	5.475													15	20 (P)*
14	9.883	0.867	12.371	1.380	14.820	2.028	17.217	2.802	19.547	3.692	21.798	4.686															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 19 Degrees

Δ=19°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	458.374	34.872	460.876	34.886	463.378	34.901	465.881	34.916	468.383	34.933	470.886	34.950	473.389	34.968	475.892	34.987	478.395	35.007	480.899	35.028	483.402	35.050	485.905	35.072	488.409	35.095	2500	
2200	408.173	30.715	410.676	30.731	413.178	30.748	415.681	30.765	418.184	30.784	420.688	30.804	423.191	30.825	425.694	30.846	428.198	30.869	430.701	30.892	433.205	30.917	435.709	30.942	438.213	30.969	2200	
2000	374.707	27.946	377.209	27.964	379.712	27.982	382.215	28.002	384.719	28.022	387.222	28.044	389.726	28.067	392.229	28.090	394.733	28.115	397.238	28.141	399.742	28.168	402.246	28.196	404.750	28.225	2000	
1800	341.240	25.180	343.744	25.199	346.247	25.220	348.750	25.242	351.254	25.265	353.758	25.289	356.262	25.314	358.766	25.340	361.270	25.368	363.775	25.396	366.279	25.427	368.784	25.458	371.289	25.490	1800	
1500	291.042	21.039	293.546	21.062	296.050	21.086	298.554	21.113	301.058	21.140	303.563	21.169	306.068	21.199	308.573	21.231	311.077	21.264	313.583	21.298	316.088	21.334	318.594	21.371	321.100	21.410	1500	
1200	240.847	16.912	243.351	16.941	245.856	16.972	248.361	17.004	250.866	17.039	253.372	17.075	255.877	17.113	258.384	17.152	260.890	17.194	263.396	17.237	265.903	17.281	268.410	17.328	270.917	17.376	1200	
1000	207.385	14.176	209.890	14.211	212.396	14.248	214.902	14.287	217.408	14.328	219.915	14.371	222.421	14.417	224.928	14.464	227.436	14.514	229.943	14.565	232.451	14.619	234.959	14.675	237.468	14.733	1000	
900	190.655	12.815	193.161	12.854	195.667	12.895	198.174	12.938	200.681	12.984	203.188	13.032	205.695	13.083	208.203	13.135	210.711	13.191	213.219	13.248	215.728	13.308	218.237	13.370	220.746	13.435	900	
800	173.926	11.462	176.433	11.506	178.940	11.552	181.447	11.601	183.955	11.652	186.463	11.707	188.971	11.763	191.479	11.823	193.988	11.885	196.497	11.949	199.007	12.017	201.517	12.087	204.027	12.159	800	
700	157.199	10.120	159.706	10.170	162.214	10.223	164.722	10.279	167.231	10.337	169.740	10.399	172.249	10.464	174.759	10.532	177.268	10.603	179.779	10.677	182.289	10.753	184.800	10.833	187.312	10.916	700	
600	140.474	8.794	142.982	8.852	145.491	8.914	148.000	8.979	150.510	9.047	153.020	9.119	155.531	9.195	158.042	9.274	160.553	9.357	163.064	9.443	165.576	9.533	168.089	9.626	170.601	9.723	600	
500	123.752	7.493	126.262	7.563	128.772	7.637	131.283	7.715	133.794	7.797	136.306	7.884	138.818	7.975	141.330	8.070	143.843	8.169	146.356	8.272	148.870	8.380	151.384	8.492	153.899	8.607	500	
400	107.035	6.238	109.547	6.325	112.059	6.417	114.572	6.515	117.085	6.618	119.599	6.726	122.113	6.839	124.628	6.958	127.143	7.082	129.658	7.211	132.174	7.345	134.690	7.485	137.207	7.630	400	
360	100.351	5.757	102.863	5.853	105.377	5.956	107.890	6.064	110.405	6.178	112.919	6.299	115.435	6.425	117.950	6.557	120.466	6.694	122.983	6.837	125.500	6.987	128.017	7.142	130.534	7.303	360	100 (P)*
350	98.680	5.639	101.193	5.739	103.706	5.844	106.220	5.956	108.735	6.073	111.250	7.197	113.765	6.326	116.281	6.462	118.798	6.603	121.314	6.751	123.831	6.904	126.349	7.064	128.867	7.229	350	
300	90.328	5.073	92.842	5.188	95.357	5.311	97.873	5.441	100.389	5.578	102.905	5.722	105.422	5.874	107.939	6.032	110.457	6.197	112.975	6.369	115.493	6.548	118.012	6.733	120.531	6.927	300	
250	81.980	4.557	84.496	4.696	87.013	4.844	89.530	4.999	92.048	5.164	94.566	5.337	97.084	5.518	99.603	5.707	102.121	5.905	104.640	6.111	107.160	6.325	109.679	6.548	112.198	6.779	250	
230	78.642	4.373	81.159	4.524	83.677	4.684	86.195	4.853	88.713	5.032	91.231	5.220	93.750	5.416	96.269	5.622	98.788	5.837	101.308	6.061	103.827	6.294	106.346	6.536	108.865	6.786	230	80 (P)*
200	73.638	4.131	76.156	4.305	78.675	4.489	81.193	4.684	83.712	4.889	86.232	5.104	88.751	5.330	91.270	5.566	93.789	5.813	96.308	6.070	98.827	6.337	101.346	6.615	103.864	6.903	200	
170	68.637	3.951	71.156	4.155	73.675	4.372	76.194	4.600	78.713	4.841	81.232	5.094	83.751	5.360	86.270	5.637	88.788	5.927	91.305	6.228	93.822	6.542	96.338	6.868	98.854	7.205	170	
155	66.137	3.896	68.656	4.119	71.175	4.356	73.694	4.607	76.213	4.871	78.732	5.148	81.250	5.438	83.767	5.742	86.284	6.059	88.800	6.389	91.314	6.733	93.828	7.089	96.340	7.459	155	65 (P)*
125	61.137	3.893	63.656	4.170	66.174	4.463	68.691	4.773	71.207	5.099	73.722	5.441	76.235	5.799	78.747	6.174	81.257	6.565	83.764	6.972	86.270	7.395	88.773	7.834	91.274	8.289	125	
100	56.966	4.079	59.480	4.423	61.993	4.788	64.503	5.173	67.012	5.578	69.517	6.003	72.019	6.447	74.518	6.912	77.013	7.396	79.504	7.900	81.990	8.423	84.472	8.966	86.949	9.527	100	
90	55.291	4.235	57.802	4.616	60.310	5.020	62.815	5.446	65.317	5.894	67.815	6.364	70.308	6.856	72.797	7.370	75.281	7.905	77.759	8.461	80.232	9.038	82.699	9.637	85.159	10.256	90	50 (P)*
80	53.609	4.462	56.114	4.890	58.615	5.342	61.111	5.819	63.603	6.320	66.089	6.846	68.569	7.395	71.043	7.969	73.510	8.566	75.970	9.186	78.422	9.829	80.866	10.496	83.301	11.184	80	50 (H)**
70	51.913	4.791	54.407	5.277	56.896	5.790	59.378	6.331	61.854	6.900	64.321	7.495	66.780	8.117	69.231	8.765	71.672	9.439	74.102	10.139	76.522	10.864	78.931	11.614	81.328	12.389	70	
60	50.187	5.270	52.664	5.831	55.132	6.424	57.591	7.048	60.039	7.703	62.476	8.388	64.900	9.103	67.312	9.847	69.710	10.619	72.094	11.419	74.463	12.247	76.816	13.102	79.152	13.983	60	40 (P)*
55	49.305	5.589	51.768	6.198	54.221	6.840	56.661	7.515	59.089	8.223	61.502	8.963	63.901	9.734	66.284	10.536	68.651	11.367	71.000	12.228	73.331	13.117	75.643	14.034	77.936	14.978	55	
50	48.401	5.981	50.846	6.645	53.277	7.345	55.692	8.080	58.092	8.849	60.474	9.652	62.838	10.488	65.183	11.356	67.508	12.255	69.811	13.184	72.092	14.143	74.350	15.130	76.584	16.143	50	40 (H)**
45	47.464	6.467	49.882	7.197	52.283	7.964	54.664	8.769	57.025	9.611	59.364	10.487	61.681	11.398	63.973	12.342	66.240	13.318	68.481	14.324	70.695	15.360	72.880	16.424	75.036	17.515	45	35 (P)*
40	46.473	7.079	48.853	7.887	51.210	8.735	53.543	9.622	55.849	10.548	58.127	11.509	60.376	12.507	62.595	13.537	64.782	14.599	66.937	15.692							40	30 (H)**
35	45.394	7.861	47.717	8.762	50.010	9.706	52.270	10.691	54.495	11.714	56.685	12.774															35	
33	44.925	8.235	47.217	9.179	49.475	10.166	51.696	11.194	53.879	12.261																	33	30 (P)*
30	44.160	8.879	46.394	9.892	48.587	10.949																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 20 Degrees

$\Delta = 20°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	448.318	38.570	450.818	38.573	453.319	38.577	455.820	38.582	458.321	38.587	460.822	38.594	463.323	38.601	465.824	38.609	468.326	38.618	470.828	38.628	473.329	38.638	475.831	38.650	478.333	38.662	2500	
2200	395.420	33.943	397.920	33.946	400.421	33.950	402.922	33.956	405.423	33.962	407.925	33.969	410.426	33.978	412.927	33.987	415.429	33.997	417.931	34.008	420.433	34.020	422.935	34.033	425.438	34.047	2200	
2000	360.155	30.858	362.655	30.862	365.156	30.866	367.657	30.872	370.158	30.879	372.660	30.887	375.161	30.896	377.663	30.906	380.165	30.917	382.667	30.929	385.169	30.943	387.671	30.957	390.174	30.972	2000	
1800	324.889	27.773	327.390	27.777	329.891	27.782	332.392	27.789	334.893	27.797	337.395	27.806	339.897	27.815	342.398	27.827	344.900	27.839	347.403	27.853	349.905	27.867	352.408	27.883	354.911	27.900	1800	
1500	271.991	23.146	274.492	23.151	276.993	23.157	279.495	23.165	281.996	23.174	284.498	23.185	287.000	23.197	289.502	23.210	292.005	23.225	294.508	23.242	297.010	23.259	299.514	23.278	302.017	23.299	1500	
1200	219.094	18.520	221.595	18.526	224.096	18.534	226.598	18.544	229.100	18.555	231.602	18.569	234.104	18.583	236.607	18.600	239.110	18.619	241.614	18.639	244.117	18.661	246.621	18.685	249.125	18.710	1200	
1000	183.828	15.436	186.330	15.444	188.831	15.453	191.333	15.465	193.836	15.479	196.338	15.494	198.841	15.512	201.345	15.532	203.848	15.554	206.352	15.579	208.857	15.605	211.361	15.634	213.866	15.665	1000	
900	166.196	13.895	168.697	13.903	171.199	13.914	173.701	13.926	176.204	13.941	178.707	13.959	181.210	13.979	183.714	14.001	186.218	14.026	188.722	14.053	191.227	14.083	193.732	14.114	196.238	14.148	900	
800	148.564	12.353	151.065	12.362	153.567	12.374	156.070	12.389	158.572	12.406	161.076	12.426	163.579	12.448	166.084	12.473	168.588	12.501	171.093	12.532	173.598	12.565	176.104	12.600	178.610	12.639	800	
700	130.931	10.812	133.433	10.823	135.935	10.836	138.438	10.853	140.941	10.873	143.445	10.895	145.949	10.921	148.454	10.950	150.959	10.981	153.465	11.016	155.971	11.054	158.477	11.095	160.984	11.138	700	100 (P)*
600	113.299	9.272	115.801	9.284	118.304	9.300	120.807	9.319	123.311	9.342	125.815	9.369	128.320	9.399	130.825	9.432	133.331	9.469	135.838	9.510	138.345	9.554	140.852	9.602	143.360	9.653	600	
500	95.667	7.732	98.169	7.747	100.672	7.766	103.176	7.789	105.681	7.817	108.186	7.849	110.692	7.885	113.198	7.925	115.705	7.969	118.213	8.018	120.721	8.071	123.230	8.128	125.739	8.189	500	
400	78.035	6.194	80.538	6.213	83.042	6.237	85.547	6.266	88.052	6.300	90.558	6.340	93.066	6.385	95.573	6.435	98.082	6.490	100.591	6.552	103.101	6.617	105.612	6.689	108.123	6.765	400	
360	70.982	5.580	73.486	5.601	75.990	5.627	78.495	5.659	81.001	5.698	83.508	5.741	86.016	5.792	88.525	5.847	91.034	5.909	93.544	5.977	96.055	6.050	98.567	6.129	101.079	6.215	360	
350	69.219	5.427	71.723	5.448	74.227	5.475	76.732	5.508	79.239	5.547	81.746	5.593	84.254	5.644	86 763	5.701	89.272	5.765	91.783	5.834	94.294	5.910	96.806	5.991	99.318	6.079	350	
300	60.403	4.660	62.908	4.685	65.413	4.716	67.919	4.755	70.426	4.801	72.934	4.854	75.443	4.914	77.953	4.980	80.464	5.054	82.976	5.135	85.489	5.224	88.002	5.319	90.516	5.421	300	80 (P)*
250	51.588	3.895	54.093	3.924	56.599	3.962	59.106	4.009	61.615	4.064	64.124	4.127	66.635	4.199	69.147	4.280	71.659	4.368	74.173	4.466	76.688	4.571	79.203	4.685	81.719	4.808	250	
230	48.062	3.590	50.567	3.622	53.074	3.663	55.582	3.714	58.091	3.773	60.601	3.842	63.113	3.921	65.625	4.008	68.139	4.104	70.653	4.210	73.168	4.325	75.685	4.449	78.201	4.582	230	
200	42.773	3.133	45.279	3.170	47.787	3.218	50.296	3.276	52.806	3.344	55.317	3.424	57.830	3.514	60.344	3.614	62.859	3.725	65.375	3.846	67.892	3.978	70.409	4.121	72.928	4.274	200	
170	37.485	2.679	39.992	2.722	42.500	2.778	45.011	2.846	47.522	2.927	50.035	3.021	52.550	3.126	55.066	3.244	57.582	3.375	60.100	3.518	62.618	3.673	65.138	3.840	67.658	4.020	170	65 (P)*
155	34.841	2.453	37.348	2.500	39.858	2.562	42.369	2.637	44.881	2.725	47.395	2.828	49.911	2.943	52.427	3.073	54.945	3.216	57.464	3.372	59.983	3.543	62.503	3.726	65.024	3.923	155	
125	29.653	2.004	32.062	2.064	34.573	2.140	37.087	2.231	39.601	2.343	42.118	2.469	44.635	2.613	47.154	2.773	49.674	2.950	52.195	3.144	54.715	3.355	57.237	3.582	59.758	3.826	125	
100	23.148	1.638	25.658	1.712	28.172	1.807	30.688	1.923	33.205	2.080	35.723	2.279	38.243	2.398	40.763	2.598	43.285	2.819	45.807	3.061	48.328	3.324	50.849	3.607	53.369	3.911	100	
90	23.386	1.494	25.898	1.536	28.412	1.682	30.929	1.811	33.447	1.964	35.967	2.139	38.488	2.338	41.009	2.560	43.530	2.806	46.051	3.074	48.572	3.365	51.092	3.680	53.610	4.016	90	50 (P)*
80	21.625	1.353	24.138	1.446	26.653	1.564	29.171	1.710	31.691	1.881	34.211	2.078	36.732	2.302	39.254	2.552	41.775	2.827	44.295	3.129	46.814	3.455	49.331	3.808	51.846	4.186	80	50 (H)**
70	19.864	1.216	22.378	1.321	24.895	1.457	27.414	1.623	29.935	1.819	32.456	2.044	34.977	2.299	37.498	2.584	40.018	2.898	42.536	3.242	45.053	3.674	47.569	4.015	50.071	4.445	70	
60	18.103	1.084	20.619	1.207	23.138	1.366	25.658	1.559	28.180	1.787	30.701	2.049	33.221	2.346	35.740	2.678	38.256	3.043	40.768	3.442	43.276	3.874	45.779	4.339	48.276	4.837	60	40 (P)*
55	17.223	1.021	19.740	1.156	22.260	1.328	24.781	1.539	27.302	1.787	29.823	2.074	32.342	2.397	34.858	2.757	37.371	3.155	39.879	3.589	42.381	4.058	44.876	4.564	47.363	5.104	55	
50	16.344	0.962	18.862	1.109	21.382	1.299	23.903	1.530	26.424	1.803	28.944	2.118	31.461	2.473	33.974	2.868	36.481	3.304	38.982	3.779	41.475	4.293	43.960	4.846	46.434	5.437	50	40 (H)**
45	15.464	0.906	17.983	1.070	20.504	1.260	23.026	1.537	25.546	1.840	28.063	2.188	30.576	2.581	33.083	3.019	35.583	3.501	38.074	4.026	40.555	4.593	43.024	5.203	45.479	5.854	45	35 (P)*
40	14.586	0.852	17.106	1.039	19.627	1.276	22.148	1.564	24.665	1.904	27.179	2.294	29.686	2.735	32.184	3.225	34.672	3.763	37.147	4.349	39.609	4.982	42.054	5.661	44.482	6.384	40	35 (H) 30 (P)*
35	13.707	0.811	16.228	1.022	18.749	1.292	21.268	1.621	23.781	2.008	26.288	2.452	28.784	2.952	31.268	3.508	33.736	4.117	36.188	4.779	38.619	5.493	41.029	6.256	43.415	7.068	35	
33	13.356	0.797	15.877	1.020	18.398	1.306	20.915	1.654	23.426	2.064	25.928	2.534	28.418	3.063	30 893	3.649	33.351	4.293	35 789	4.991	38.205	5.742	40.595	6.545	42.957	7.397	33	
30	12.829	0.779	15.350	1.025	17.870	1.339	20.384	1.721	22.890	2.170	25.383	2.684	27.861	3.262	30.319	3.902	32.756	4.603	35.168	5.362	37.551	6.178	39.904	7.047	42.222	7.967	30	30 (H)**
25	11.952	0.765	14.472	1.059	16.987	1.434	19.491	1.869	21.980	2.423	24.449	3.032	26.892	3.715	29.307	4.469	31.687	5.289	34.030	6.174	36.330	7.120	38.585	8.121	40.791	9.176	25	
23	11.601	0.767	14.120	1.086	16.631	1.492	19.129	1.985	21.607	2.562	24.059	3.220	26.482	3.955	28.868	4.764	31.214	5.644	33.515	6.589	35.766	7.596	37.963	8.659			23	25 (P)*
20	11.074	0.782	13.589	1.147	16.092	1.612	18.574	2.175	21.027	2.830	23.445	3.575	25.821	4.404	28.148	5.312	30.421	6.293	32.633	7.341							20	25 (H)**
15	10.192	0.860	12.691	1.342	15.160	1.951	17.584	2.681	19.952	3.523	22.252	4.468	24.475	5.505													15	20 (P)*
14	10.014	0.889	12.507	1.403	14.962	2.052	17.366	2.827	19.704	3.718	21.964	4.714															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 20 Degrees

Δ=20°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	480.836	38.675	483.338	38.689	485.841	38.704	488.343	38.719	490.846	38.736	493.349	38.753	495.852	38.771	498.355	38.791	500.858	38.810	503.362	38.831	505.865	38.853	508.369	38.875	510.873	38.898	2500	
2200	427.940	34.062	430.443	34.077	432.945	34.094	435.448	34.112	437.952	34.131	440.455	34.151	442.958	34.171	445.462	34.193	447.966	34.216	450.469	34.239	452.974	34.264	455.478	34.289	457.982	34.315	2200	
2000	392.677	30.989	395.180	31.006	397.683	31.025	400.186	31.044	402.689	31.065	405.193	31.087	407.697	31.109	410.201	31.133	412.705	31.158	415.209	31.184	417.714	31.211	420.218	31.239	422.723	31.268	2000	
1800	357.414	27.918	359.917	27.938	362.420	27.958	364.924	27.980	367.428	28.003	369.932	28.027	372.436	28.052	374.940	28.079	377.445	28.106	379.950	28.135	382.454	28.165	384.959	28.196	387.465	28.229	1800	
1500	304.521	23.320	307.024	23.344	309.529	23.368	312.033	23.395	314.537	23.422	317.042	23.451	319.547	23.481	322.052	23.513	324.558	23.546	327.063	23.581	329.569	23.617	332.075	23.654	334.581	23.693	1500	
1200	251.630	18.738	254.135	18.767	256.640	18.798	259.145	18.830	261.651	18.865	264.156	18.901	266.663	18.939	269.169	18.978	271.675	19.020	274.182	19.063	276.689	19.108	279.197	19.155	281.704	19.203	1200	
1000	216.372	15.697	218.877	15.732	221.383	15.769	223.890	15.808	226.396	15.850	228.903	15.893	231.410	15.938	233.918	15.986	236.425	16.036	238.934	16.088	241.442	16.142	243.951	16.198	246.459	16.256	1000	
900	198.744	14.185	201.250	14.224	203.757	14.265	206.263	14.308	208.771	14.354	211.278	14.402	213.786	14.453	216.294	14.505	218.803	14.561	221.312	14.618	223.821	14.678	226.330	14.740	228.840	14.805	900	
800	181.117	12.680	183.624	12.723	186.131	12.770	188.639	12.819	191.147	12.870	193.655	12.924	196.164	12.981	198.673	13.041	201.182	13.103	203.692	13.167	206.202	13.235	208.713	13.305	211.224	13.377	800	
700	163.492	11.185	165.999	11.235	168.508	11.288	171.016	11.344	173.525	11.403	176.035	11.465	178.544	11.530	181.055	11.598	183.565	11.669	186.076	11.743	188 587	11.820	191.099	11.900	193.611	11.983	700	
600	145.869	9.707	148.377	9.765	150.887	9.827	153.397	9.892	155.907	9.961	158.418	10.033	160.929	10.109	163.440	10.188	165.952	10.271	168.465	10.357	170.978	10.447	173.491	10.541	176.004	10.637	600	
500	128.249	8.255	130.759	8.324	133.270	8.398	135.782	8.477	138.294	8.559	140.806	8.646	143.319	8.737	145.832	8.832	148.346	8.931	150.860	9.035	153.375	9.143	155.890	9.255	158.406	9.371	500	
400	110.635	6.847	113.147	6.935	115.660	7.027	118.174	7.125	120.688	7.228	123.203	7.336	125.718	7.450	128.234	7.569	130.750	7.693	133.267	7.822	135.784	7.957	138.301	8.096	140.819	8.242	400	
360	103.592	6.305	106.105	6.402	108.619	6.505	111.134	6.614	113.649	6.728	116.165	6.848	118.682	6.975	121.198	7.106	123.716	7.244	126.233	7.388	128.752	7.538	131.270	7.693	133.789	7.854	360	100 (P)*
350	101.831	6.173	104.345	6.272	106.860	6.378	109.375	6.490	111.890	6.607	114.406	6.731	116.923	6.861	119.440	6.997	121.958	7.138	124.476	7.286	126.994	7.440	129.513	7.600	132.032	7.765	350	
300	93.031	5.530	95.546	5.646	98.063	5.769	100.579	5.900	103.096	6.037	105.614	6.181	108.132	6.332	110.651	6.491	113.170	6.656	115.690	6.828	118.210	7.007	120.730	7.194	123.250	7.387	300	
250	84.236	4.939	86.753	5.078	89.271	5.226	91.790	5.382	94.309	5.547	96.828	5.720	99.348	5.901	101.868	6.091	104.389	6.289	106.910	6.495	109.431	6.710	111.952	6.933	114.474	7.165	250	
230	80.719	4.724	83.237	4.876	85.756	5.036	88.276	5.206	90.795	5.385	93.316	5.572	95.836	5.769	98.357	5.975	100.878	6.191	103.399	6.415	105.921	6.648	108.442	6.890	110.964	7.142	230	80 (P)*
200	75.447	4.437	77.966	4.611	80.487	4.796	83.007	4.991	85.528	5.196	88.049	5.412	90.570	5.638	93.092	5.875	95.613	6.122	98.134	6.379	100.656	6.647	103.177	6.925	105.697	7.214	200	
170	70.178	4.212	72.699	4.417	75.220	4.633	77.741	4.862	80.263	5.104	82.784	5.357	85.305	5.623	87.826	5.901	90.347	6.190	92.867	6.493	95.387	6.807	97.906	7.133	100.424	7.471	170	
155	67.545	4.134	70.066	4.358	72.587	4.596	75.109	4.846	77.630	5.111	80.151	5.388	82.672	5.679	85.192	5.983	87.711	6.301	90.230	6.632	92.748	6.975	95.264	7.332	97.780	7.702	155	65 (P)*
125	62.280	4.087	64.801	4.364	67.321	4.657	69.841	4.967	72.360	5.294	74.878	5.637	77.394	5.996	79.909	6.371	82.422	6.762	84.934	7.170	87.443	7.594	89.950	8.033	92.455	8.489	125	
100	57.888	4.235	60.405	4.580	62.921	4.945	65.435	5.330	67.947	5.736	70.456	6.162	72.962	6.607	75.465	7.072	77.964	7.557	80.460	8.062	82.951	8.586	85.438	9.129	87.920	9.692	100	
90	56.126	4.376	58.641	4.758	61.152	5.162	63.661	5.589	66.167	6.038	68.669	6.509	71.166	7.001	73.660	7.516	76.148	8.051	78.632	8.609	81.110	9.187	83.582	9.786	86.047	10.406	90	50 (P)*
80	54.358	4.589	56.866	5.017	59.371	5.470	61.872	5.948	64.368	6.450	66.859	6.976	69.344	7.526	71.822	8.101	74.295	8.699	76.760	9.320	79.218	9.964	81.667	10.631	84.109	11.321	80	50 (H)**
70	52.575	4.903	55.074	5.390	57.568	5.904	60.055	6.446	62.535	7.015	65.008	7.611	67.473	8.234	69.929	8.883	72.375	9.559	74.812	10.260	77.239	10.986	79.654	11.737	82.059	12.512	70	
60	50.766	5.368	53.243	5.930	55.721	6.524	58.185	7.149	60.639	7.805	63.082	8.491	65.513	9.206	67.931	9.951	70.336	10.725	72.727	11.526	75.103	12.355	77.463	13.212	79.808	14.094	60	40 (P)*
55	49.842	5.680	52.311	6.289	54.769	6.933	57.215	7.609	59.649	8.318	62.069	9.059	64.475	9.831	66.865	10.634	69.239	11.467	71.596	12.329	73.935	13.219	76.255	14.138	78.556	15.083	55	
50	48.897	6.065	51.348	6.730	53.785	7.431	56.207	8.167	58.613	8.937	61.003	9.742	63.374	10.579	65.727	11.448	68.059	12.349	70.371	13.279	72.660	14.239	74.927	15.227	77.171	16.243	50	40 (H)**
45	47.920	6.545	50.345	7.275	52.752	8.044	55.140	8.850	57.509	9.692	59.856	10.570	62.180	11.483	64.481	12.428	66.757	13.405	69.007	14.413	71.230	15.451	73.424	16.516	75.590	17.609	45	35 (P)*
40	46.891	7.150	49.278	7.958	51.642	8.808	53.982	9.696	56.297	10.623	58.583	11.587	60.842	12.585	63.070	13.617	65.266	14.681	67.430	15.775							40	30 (H)**
35	45.774	7.925	48.105	8.828	50.406	9.773	52.674	10.759	54.909	11.784	57.108	12.846															35	
33	45.290	8.297	47.591	9.242	49.857	10.231	52.088	11.260	54.280	12.329																	33	30 (P)*
30	44.505	8.937	46.748	9.952	48.950	11.011																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 21 Degrees

$\Delta = 21°$

R_C	$L_s = 15$ metres		$L_s = 20$ metres		$L_s = 25$ metres		$L_s = 30$ metres		$L_s = 35$ metres		$L_s = 40$ metres		$L_s = 45$ metres		$L_s = 50$ metres		$L_s = 55$ metres		$L_s = 60$ metres		$L_s = 65$ metres		$L_s = 70$ metres		$L_s = 75$ metres		R_f	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	470.848	42.581	473.348	42.583	475.849	42.587	478.350	42.592	480.851	42.598	483.352	42.604	485.853	42.611	488.355	42.619	490.856	42.628	493.358	42.638	495.860	42.648	498.362	42.660	500.864	42.672	2500	
2200	415.246	37.472	417.747	37.475	420.248	37.479	422.749	37.485	425.250	37.491	427.751	37.498	430.253	37.507	432.754	37.516	435.256	37.526	437.758	37.537	440.260	37.549	442.762	37.562	445.265	37.576	2200	
2000	378.178	34.066	380.679	34.070	383.180	34.075	385.681	34.081	388.182	34.087	390.684	34.095	393.186	34.104	395.687	34.114	398.189	34.125	400.691	34.138	403.194	34.151	405.696	34.165	408.199	34.181	2000	
1800	341.111	30.660	343.612	30.665	346.113	30.670	348.614	30.677	351.115	30.684	353.617	30.693	356.119	30.703	358.620	30.714	361.123	30.727	363.625	30.740	366.128	30.755	368.630	30.771	371.134	30.788	1800	
1500	285.510	25.552	288.010	25.558	290.511	25.564	293.013	25.571	295.515	25.581	298.017	25.591	300.519	25.603	303.021	25.617	305.524	25.632	308.026	25.648	310.530	25.666	313.033	25.685	315.537	25.705	1500	
1200	229.908	20.445	232.409	20.451	234.911	20.459	237.412	20.469	239.914	20.480	242.417	20.493	244.919	20.508	247.422	20.525	249.926	20.544	252.429	20.564	254.933	20.586	257.437	20.610	259.942	20.635	1200	
1000	192.841	17.040	195.342	17.048	197.844	17.057	200.346	17.069	202.848	17.083	205.351	17.098	207.854	17.117	210.358	17.137	212.862	17.159	215.366	17.183	217.870	17.210	220.375	17.238	222.881	17.269	1000	
900	174.307	15.338	176.808	15.346	179.310	15.357	181.813	15.370	184.315	15.385	186.818	15.403	189.322	15.423	191.826	15.445	194.330	15.470	196.835	15.497	199.340	15.527	201.845	15.558	204.351	15.593	900	
800	155.773	13.636	158.275	13.646	160.777	13.658	163.280	13.672	165.783	13.689	168.286	13.709	170.790	13.732	173.294	13.757	175.799	13.785	178.304	13.815	180.810	13.848	183.316	13.884	185.823	13.923	800	
700	137.240	11.935	139.742	11.946	142.244	11.959	144.747	11.976	147.250	11.996	149.754	12.018	152.259	12.044	154.764	12.073	157.269	12.104	159.775	12.139	162.281	12.177	164.788	12.218	167.296	12.262	700	100 (P)*
600	118.706	10.234	121.208	10.247	123.711	10.263	126.215	10.282	128.719	10.305	131.223	10.331	133.728	10.361	136.234	10.395	138.740	10.432	141.247	10.473	143.755	10.517	146.262	10.564	148.771	10.616	600	
500	100.173	8.534	102.675	8.549	105.179	8.568	107.683	8.592	110.188	8.619	112.693	8.651	115.199	8.687	117.706	8.727	120.213	8.771	122.721	8.821	125.230	8.873	127.739	8.930	130.249	8.992	500	
400	81.640	6.836	84.143	6.855	86.647	6.879	89.152	6.908	91.658	6.942	94.165	6.982	96.672	7.027	99.181	7.077	101.690	7.133	104.199	7.194	106.710	7.260	109.221	7.331	111.733	7.408	400	
360	74.227	6.158	76.730	6.178	79.235	6.205	81.740	6.237	84.247	6.275	86.754	6.319	89.262	6.369	91.772	6.425	94.282	6.487	96.792	6.555	99.304	6.628	101.816	6.708	104.329	6.793	360	
350	72.373	5.988	74.877	6.009	77.382	6.036	79.888	6.070	82.394	6.109	84.902	6.155	87.410	6.206	89.919	6.263	92.430	6.327	94.941	6.396	97.452	6.472	99.965	6.554	102.478	6.642	350	
300	63.107	5.141	65.612	5.166	68.117	5.198	70.624	5.236	73.131	5.282	75.640	5.335	78.150	5.395	80.660	5.462	83.172	5.536	85.684	5.617	88.198	5.706	90.712	5.801	93.227	5.903	300	80 (P)*
250	53.841	4.296	56.347	4.325	58.853	4.364	61.361	4.410	63.870	4.465	66.380	4.529	68.891	4.601	71.404	4.681	73.917	4.770	76.431	4.868	78.947	4.973	81.463	5.088	83.980	5.210	250	
230	50.135	3.955	52.641	3.991	55.148	4.032	57.656	4.083	60.166	4.143	62.677	4.212	65.189	4.290	67.702	4.377	70.216	4.474	72.732	4.580	75.248	4.695	77.765	4.819	80.283	4.952	230	
200	44.576	3.454	47.082	3.491	49.590	3.539	52.100	3.597	54.611	3.666	57.123	3.745	59.636	3.835	62.151	3.936	64.667	4.047	67.184	4.168	69.702	4.300	72.221	4.443	74.741	4.596	200	
170	39.017	2.951	41.525	2.995	44.034	3.051	46.545	3.119	49.057	3.200	51.571	3.294	54.086	3.400	56.603	3.518	59.121	3.649	61.640	3.792	64.160	3.947	66.680	4.115	69.202	4.295	170	65 (P)*
155	36.238	2.701	38.746	2.749	41.256	2.811	43.768	2.886	46.281	2.975	48.796	3.077	51.313	3.193	53.830	3.323	56.349	3.466	58.869	3.623	61.390	3.793	63.912	3.977	66.434	4.174	155	
125	30.680	2.205	33.190	2.264	35.702	2.341	38.216	2.441	40.732	2.544	43.249	2.671	45.768	2.815	48.288	2.975	50.810	3.153	53.332	3.347	55.855	3.558	58.378	3.785	60.902	4.030	125	
100	26.050	1.798	28.561	1.873	31.076	1.968	33.592	2.084	36.111	2.222	38.631	2.380	41.152	2.560	43.675	2.760	46.198	2.981	48.721	3.224	51.245	3.487	53.768	3.770	56.291	4.075	100	
90	24.198	1.639	26.711	1.721	29.226	1.827	31.744	1.956	34.263	2.109	36.785	2.285	39.307	2.484	41.830	2.707	44.354	2.952	46.877	3.221	49.401	3.513	51.923	3.827	54.444	4.165	90	50 (P)*
80	22.347	1.482	24.860	1.574	27.377	1.693	29.896	1.839	32.417	2.010	34.940	2.208	37.463	2.432	39.986	2.682	42.510	2.958	45.033	3.260	47.555	3.587	50.075	3.940	52.593	4.319	80	50 (H)**
70	20.496	1.328	23.011	1.434	25.526	1.560	28.050	1.736	30.572	1.932	33.095	2.158	35.619	2.414	38.142	2.699	40.665	3.013	43.186	3.357	45.704	3.730	48.220	4.132	50.732	4.563	70	
60	18.645	1.181	21.163	1.304	23.683	1.463	26.205	1.656	28.728	1.884	31.252	2.147	33.775	2.445	36.296	2.777	38.815	3.142	41.331	3.542	43.843	3.975	46.350	4.441	48.851	4.940	60	40 (P)*
55	17.721	1.110	20.239	1.245	22.760	1.417	25.283	1.628	27.806	1.877	30.329	2.164	32.851	2.488	35.371	2.849	37.887	3.247	40.399	3.681	42.905	4.152	45.405	4.658	47.897	5.199	55	
50	16.796	1.042	19.315	1.190	21.837	1.380	24.361	1.612	26.884	1.885	29.406	2.200	31.926	2.555	34.443	2.952	36.954	3.388	39.459	3.864	41.957	4.379	44.447	4.932	46.926	5.524	50	40 (H)**
45	15.872	0.978	18.392	1.142	20.915	1.353	23.439	1.611	25.962	1.914	28.482	2.263	30.998	2.656	33.510	3.095	36.014	3.577	38.509	4.103	40.995	4.672	43.469	5.282	45.930	5.934	45	35 (P)*
40	14.948	0.918	17.470	1.104	19.993	1.341	22.516	1.630	25.037	1.970	27.554	2.361	30.065	2.802	32.568	3.293	35.060	3.832	37.541	4.419	40.008	5.053	42.460	5.733	44.894	6.457	40	35 (H) 30 (P)*
35	14.025	0.868	16.548	1.079	19.071	1.349	21.593	1.679	24.110	2.066	26.620	2.511	29.121	3.012	31.609	3.568	34.083	4.179	36.541	4.842	38.979	5.557	41.395	6.321	43.788	7.134	35	
33	13.656	0.850	16.179	1.074	18.702	1.360	21.223	1.709	23.737	2.119	26.243	2.590	28.738	3.120	31.219	3.707	33.682	4.352	36.126	5.051	38.548	5.803	40.946	6.607	43.316	7.461	33	
30	13.102	0.828	15.626	1.074	18.148	1.388	20.666	1.771	23.175	2.220	25.673	2.735	28.156	3.315	30.620	3.956	33.063	4.658	35.482	5.418	37.873	6.235	40.233	7.105	42.559	8.027	30	30 (E)**
25	12.180	0.806	14.703	1.100	17.221	1.476	19.730	1.932	22.223	2.466	24.697	3.077	27.147	3.761	29.568	4.515	31.956	5.337	34.306	6.224	36.615	7.170	38.879	8.174	41.095	9.230	25	
23	11.812	0.805	14.334	1.124	16.848	1.531	19.350	2.025	21.833	2.603	24.292	3.261	26.721	3.998	29.115	4.808	31.469	5.689	33.777	6.636	36.037	7.644	38.244	8.709			23	25 (P)*
20	11.258	0.815	13.777	1.181	16.284	1.647	18.770	2.210	21.230	2.866	23.655	3.612	26.038	4.442	28.373	5.352	30.654	6.334	32.876	7.384							20	25 (H)**
15	10.333	0.885	12.836	1.368	15.310	1.978	17.741	2.709	20.116	3.553	22.425	4.499	24.657	5.538													15	20 (P)*
14	10.146	0.913	12.644	1.427	15.105	2.077	17.515	2.854	19.861	3.746	22.130	4.743															14	20 (H)**

*P - Plain & Rolling Terrian **H - Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 21 Degrees

△=21°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	503.367	42.685	505.869	42.699	508.372	42.714	510.875	42.730	513.377	42.746	515.880	42.764	518.384	42.782	520.887	42.801	523.390	42.821	525.894	42.842	528.398	42.863	530.902	42.886	533.406	42.909	2500	
2200	447.767	37.591	450.270	37.607	452.773	37.624	455.276	37.641	457.780	37.660	460.283	37.680	462.787	37.701	465.291	37.722	467.795	37.745	470.299	37.769	472.803	37.793	475.307	37.819	477.812	37.845	2200	
2000	410.702	34.197	413.205	34.215	415.708	34.233	418.212	34.253	420.715	34.273	423.219	34.295	425.723	34.318	428.227	34.342	430.732	34.367	433.236	34.392	435.741	34.419	438.246	34.448	440.750	34.477	2000	
1800	373.637	30.806	376.140	30.825	378.644	30.846	381.148	30.868	383.652	30.891	386.156	30.915	388.660	30.940	391.165	30.967	393.669	30.994	396.175	31.023	398.679	31.053	401.185	31.084	403.691	31.117	1800	
1500	318.040	25.727	320.544	25.750	323.049	25.775	325.553	25.801	328.058	25.829	330.563	25.857	333.068	25.888	335.573	25.920	338.079	25.953	340.585	25.988	343.091	26.023	345.597	26.061	348.104	26.100	1500	
1200	262.446	20.663	264.951	20.692	267.457	20.723	269.962	20.755	272.468	20.790	274.974	20.826	277.481	20.864	279.987	20.904	282.494	20.945	285.001	20.989	287.509	21.033	290.017	21.081	292.525	21.129	1200	
1000	225.386	17.302	227.892	17.337	230.398	17.374	232.905	17.413	235.412	17.455	237.919	17.498	240.427	17.543	242.935	17.591	245.443	17.641	247.951	17.693	250.460	17.747	252.969	17.803	255.479	17.861	1000	
900	206.857	15.629	209.364	15.668	211.871	15.709	214.378	15.752	216.886	15.798	219.394	15.847	221.902	15.897	224.411	15.950	226.920	16.006	229.429	16.063	231.939	16.123	234.449	16.186	236.959	16.250	900	
800	188.330	13.963	190.837	14.007	193.345	14.054	195.853	14.103	198.361	14.154	200.870	14.208	203.379	14.265	205.889	14.325	208.399	14.387	210.909	14.452	213.420	14.520	215.931	14.590	218.442	14.662	800	
700	169.803	12.309	172.312	12.359	174.820	12.412	177.329	12.468	179.839	12.527	182.349	12.589	184.859	12.654	187.370	12.722	189.881	12.793	192.393	12.867	194.905	12.944	197.417	13.024	199.930	13.108	700	
600	151.280	10.670	153.789	10.729	156.299	10.791	158.810	10.856	161.320	10.925	163.832	10.997	166.344	11.073	168.856	11.152	171.369	11.235	173.882	11.322	176.395	11.412	178.909	11.505	181.424	11.602	600	
500	132.760	9.058	135.271	9.127	137.782	9.202	140.295	9.280	142.807	9.363	145.320	9.449	147.834	9.540	150.348	9.636	152.863	9.735	155.378	9.839	157.894	9.947	160.410	10.059	162.926	10.175	500	
400	114.246	7.490	116.759	7.577	119.273	7.670	121.787	7.768	124.302	7.871	126.818	7.979	129.334	8.093	131.851	8.212	134.368	8.337	136.886	8.466	139.404	8.601	141.923	8.741	144.442	8.886	400	
360	106.843	6.884	109.357	6.981	111.872	7.084	114.388	7.193	116.904	7.307	119.421	7.428	121.939	7.554	124.457	7.686	126.975	7.824	129.494	7.968	132.014	8.118	134.533	8.274	137.054	8.435	360	100 (P)*
350	104.992	6.735	107.507	6.835	110.022	6.941	112.538	7.053	115.055	7.171	117.572	7.295	120.090	7.425	122.608	7.561	125.127	7.702	127.647	7.850	130.166	8.004	132.687	8.164	135.207	8.331	350	
300	95.743	6.013	98.259	6.129	100.776	6.252	103.294	6.383	105.813	6.520	108.332	6.665	110.851	6.816	113.371	6.975	115.892	7.140	118.413	7.313	120.934	7.492	123.456	7.679	125.978	7.873	300	
250	86.498	5.342	89.017	5.481	91.536	5.629	94.056	5.785	96.577	5.950	99.098	6.124	101.619	6.305	104.141	6.495	106.664	6.694	109.186	6.900	111.709	7.115	114.233	7.339	116.756	7.571	250	
230	82.802	5.095	85.322	5.247	87.842	5.407	90.363	5.577	92.884	5.756	95.406	5.945	97.929	6.142	100.451	6.348	102.974	6.564	105.498	6.788	108.021	7.022	110.545	7.265	113.068	7.516	230	80 (P)*
200	77.261	4.760	79.782	4.935	82.304	5.119	84.826	5.315	87.349	5.520	89.872	5.736	92.395	5.963	94.919	6.200	97.442	6.447	99.966	6.705	102.490	6.973	105.013	7.252	107.536	7.541	200	
170	71.724	4.487	74.247	4.692	76.770	4.909	79.293	5.139	81.817	5.380	84.340	5.634	86.864	5.900	89.387	6.178	91.911	6.469	94.433	6.771	96.956	7.086	99.478	7.413	101.999	7.751	170	
155	68.957	4.385	71.480	4.610	74.004	4.848	76.527	5.099	79.051	5.364	81.574	5.642	84.098	5.933	86.620	6.238	89.143	6.556	91.664	6.887	94.185	7.231	96.705	7.589	99.224	7.959	155	65 (P)*
125	63.425	4.291	65.949	4.568	68.472	4.862	70.994	5.173	73.516	5.500	76.037	5.843	78.557	6.203	81.075	6.579	83.592	6.971	86.107	7.379	88.620	7.803	91.131	8.243	93.639	8.700	125	
100	58.813	4.400	61.334	4.745	63.853	5.111	66.370	5.497	68.885	5.903	71.398	6.329	73.908	6.776	76.415	7.242	78.919	7.727	81.419	8.233	83.915	8.758	86.406	9.302	88.895	9.865	100	
90	56.964	4.525	59.482	4.908	61.997	5.313	64.510	5.740	67.019	6.190	69.525	6.661	72.027	7.155	74.525	7.670	77.019	8.206	79.507	8.764	81.990	9.343	84.467	9.944	86.938	10.565	90	50 (P)*
80	55.108	4.722	57.621	5.151	60.130	5.605	62.635	6.083	65.135	6.586	67.630	7.113	70.120	7.665	72.604	8.240	75.082	8.839	77.553	9.461	80.016	10.106	82.472	10.775	84.919	11.465	80	50 (H)**
70	53.240	5.022	55.743	5.509	58.241	6.024	60.733	6.567	63.219	7.137	65.697	7.734	68.167	8.358	70.629	9.008	73.082	9.684	75.525	10.386	77.958	11.114	80.380	11.866	82.791	12.643	70	
60	51.346	5.471	53.833	6.034	56.311	6.629	58.781	7.255	61.241	7.912	63.689	8.599	66.127	9.316	68.552	10.062	70.964	10.837	73.362	11.639	75.745	12.470	78.113	13.327	80.465	14.211	60	40 (P)*
55	50.381	5.776	52.855	6.386	55.318	7.030	57.771	7.708	60.211	8.418	62.637	9.160	65.050	9.933	67.447	10.738	69.829	11.572	72.193	12.435	74.540	13.327	76.869	14.247	79.178	15.194	55	
50	49.395	6.153	51.851	6.819	54.294	7.521	56.723	8.259	59.136	9.030	61.533	9.836	63.912	10.675	66.272	11.545	68.613	12.447	70.932	13.379	73.231	14.341	75.506	15.330	77.758	16.347	50	40 (H)**
45	48.377	6.626	50.809	7.357	53.223	8.127	55.618	8.935	57.994	9.779	60.349	10.658	62.682	11.572	64.991	12.519	67.275	13.498	69.534	14.507	71.766	15.546	73.970	16.614	76.146	17.708	45	35 (P)*
40	47.309	7.224	49.703	8.034	52.075	8.885	54.423	9.775	56.746	10.703	59.041	11.668	61.308	12.668	63.545	13.702	65.751	14.768	67.925	15.863							40	30 (H)**
35	46.155	7.993	48.494	8.897	50.803	9.844	53.081	10.832	55.324	11.858	57.532	12.922															35	
33	45.657	8.362	47.966	9.309	50.241	10.299	52.480	11.330	54.682	12.400																	33	30 (P)*
30	44.850	8.998	47.102	10.015	49.314	11.076																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 22 Degrees

$\Delta = 22°$

R_C	$L_S = 15$ metres		$L_S = 20$ metres		$L_S = 25$ metres		$L_S = 30$ metres		$L_S = 35$ metres		$L_S = 40$ metres		$L_S = 45$ metres		$L_S = 50$ metres		$L_S = 55$ metres		$L_S = 60$ metres		$L_S = 65$ metres		$L_S = 70$ metres		$L_S = 75$ metres		R_O	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre			
2500	493.451	46.796	495.952	46.799	498.452	46.803	500.953	46.807	503.454	46.813	505.956	46.819	508.457	46.826	510.958	46.834	513.460	46.844	515.962	46.853	518.464	46.864	520.966	46.873	523.469	46.887	**2500**	
2200	435.137	41.181	437.638	41.185	440.139	41.189	442.640	41.194	445.141	41.201	447.642	41.208	450.144	41.216	452.646	41.225	455.147	41.235	457.649	41.246	460.152	41.259	462.654	41.271	465.157	41.285	**2200**	
2000	396.261	37.438	398.762	37.442	401.263	37.447	403.764	37.453	406.265	37.460	408.767	37.468	411.269	37.477	413.771	37.487	416.272	37.498	418.775	37.510	421.277	37.523	423.780	37.538	426.283	37.553	**2000**	
1800	357.385	33.696	359.886	33.700	362.387	33.705	364.888	33.711	367.390	33.719	369.892	33.728	372.393	33.738	374.895	33.749	377.398	33.762	379.900	33.775	382.403	33.790	384.906	33.806	387.409	33.823	**1800**	
1500	299.072	28.082	301.573	28.087	304.074	28.093	306.575	28.101	309.077	28.110	311.579	28.121	314.081	28.132	316.583	28.146	319.086	28.161	321.589	28.177	324.093	28.195	326.596	28.214	329.100	28.234	**1500**	
1200	240.758	22.468	243.259	22.474	245.760	22.482	248.262	22.492	250.764	22.503	253.267	22.517	255.770	22.532	258.273	22.549	260.776	22.567	263.280	22.587	265.784	22.610	268.288	22.634	270.793	22.659	**1200**	
1000	201.882	18.726	204.383	18.734	206.885	18.743	209.387	18.755	211.890	18.769	214.393	18.785	216.896	18.803	219.400	18.823	221.904	18.845	224.408	18.870	226.913	18.896	229.418	18.925	231.924	18.956	**1000**	
900	182.444	16.856	184.946	16.864	187.448	16.875	189.950	16.888	192.453	16.903	194.956	16.920	197.460	16.941	199.964	16.967	202.469	16.988	204.973	17.015	207.479	17.044	209.984	17.076	212.491	17.111	**900**	
800	163.006	14.985	165.508	14.995	168.010	15.007	170.513	15.021	173.016	15.038	175.520	15.058	178.024	15.081	180.529	15.106	183.034	15.134	185.539	15.165	188.045	15.198	190.551	15.233	193.058	15.272	**800**	
700	143.569	13.115	146.071	13.126	148.573	13.140	151.076	13.156	153.580	13.176	156.084	13.199	158.589	13.225	161.094	13.253	163.600	13.285	166.106	13.320	168.613	13.358	171.120	13.399	173.628	13.443	**700**	100 (P)*
600	124.131	11.246	126.633	11.259	129.136	11.274	131.640	11.294	134.144	11.317	136.649	11.343	139.154	11.373	141.660	11.407	144.167	11.444	146.674	11.485	149.182	11.529	151.690	11.577	154.199	11.628	**600**	
500	104.694	9.377	107.196	9.393	109.700	9.411	112.204	9.435	114.709	9.462	117.215	9.494	119.721	9.530	122.228	9.571	124.736	9.615	127.245	9.664	129.754	9.717	132.264	9.774	134.774	9.836	**500**	
400	85.257	7.510	87.760	7.529	90.264	7.553	92.770	7.582	95.276	7.617	97.783	7.656	100.291	7.702	102.799	7.752	105.309	7.808	107.819	7.869	110.330	7.935	112.842	8.007	115.355	8.083	**400**	
360	77.482	6.765	79.986	6.785	82.490	6.812	84.996	6.844	87.503	6.883	90.011	6.927	92.519	6.977	95.029	7.033	97.540	7.095	100.051	7.162	102.563	7.236	105.076	7.316	107.590	7.401	**360**	
350	75.538	6.578	78.042	6.599	80.547	6.627	83.053	6.660	85.560	6.699	88.068	6.745	90.577	6.796	93.087	6.854	95.597	6.918	98.109	6.987	100.621	7.063	103.135	7.145	105.649	7.233	**350**	
300	65.820	5.647	68.325	5.672	70.830	5.704	73.337	5.742	75.845	5.788	78.354	5.841	80.864	5.902	83.376	5.969	85.888	6.043	88.401	6.124	90.915	6.213	93.430	6.308	95.946	6.410	**300**	80 (P)*
250	56.102	4.717	58.607	4.747	61.114	4.785	63.622	4.832	66.132	4.887	68.643	4.951	71.155	5.023	73.668	5.104	76.182	5.193	78.697	5.290	81.214	5.396	83.731	5.511	86.249	5.633	**250**	
230	52.215	4.346	54.721	4.379	57.228	4.420	59.737	4.471	62.247	4.531	64.759	4.600	67.272	4.678	69.786	4.766	72.301	4.863	74.817	4.969	77.334	5.084	79.853	5.208	82.372	5.342	**230**	
200	46.385	3.791	48.891	3.828	51.400	3.876	53.910	3.934	56.421	4.003	58.934	4.083	61.449	4.173	63.964	4.274	66.481	4.385	68.999	4.507	71.518	4.639	74.039	4.782	76.560	4.936	**200**	
170	40.555	3.238	43.063	3.282	45.572	3.338	48.084	3.407	50.597	3.488	53.112	3.581	55.628	3.687	58.146	3.806	60.665	3.936	63.185	4.080	65.706	4.235	68.228	4.403	70.751	4.584	**170**	65 (P)*
155	37.640	2.963	40.148	3.011	42.659	3.072	45.171	3.147	47.685	3.236	50.201	3.339	52.719	3.455	55.238	3.585	57.758	3.729	60.279	3.886	62.802	4.056	65.325	4.241	67.849	4.438	**155**	
125	31.811	2.416	34.321	2.475	36.834	2.552	39.349	2.655	41.865	2.755	44.384	2.882	46.904	3.026	49.426	3.187	51.949	3.365	54.473	3.560	56.998	3.771	59.523	3.999	62.049	4.244	**125**	
100	26.955	1.967	29.467	2.041	31.982	2.137	34.500	2.253	37.019	2.391	39.541	2.550	42.064	2.730	44.588	2.930	47.113	3.152	49.639	3.395	52.165	3.658	54.691	3.942	57.216	4.247	**100**	
90	25.013	1.791	27.526	1.873	30.042	1.979	32.561	2.109	35.082	2.261	37.605	2.438	40.129	2.637	42.654	2.860	45.180	3.106	47.706	3.376	50.232	3.668	52.757	3.983	55.281	4.321	**90**	50 (P)*
80	23.071	1.617	25.586	1.709	28.103	1.829	30.624	1.974	33.146	2.146	35.670	2.344	38.196	2.569	40.721	2.819	43.247	3.096	45.773	3.398	48.298	3.726	50.821	4.079	53.342	4.459	**80**	50 (H)**
70	21.130	1.447	23.646	1.553	26.166	1.689	28.688	1.855	31.212	2.051	33.737	2.278	36.263	2.534	38.789	2.819	41.314	3.134	43.838	3.479	46.360	3.852	48.879	4.255	51.395	4.686	**70**	
60	19.189	1.269	21.708	1.406	24.229	1.564	26.753	1.758	29.278	1.987	31.804	2.250	34.330	2.548	36.854	2.881	39.377	3.247	41.896	3.647	44.412	4.081	46.923	4.548	49.429	5.047	**60**	40 (P)*
55	18.219	1.203	20.739	1.338	23.261	1.511	25.786	1.722	28.312	1.971	30.838	2.258	33.362	2.583	35.885	2.945	38.405	3.343	40.920	3.778	43.431	4.250	45.935	4.757	48.432	5.299	**55**	
50	17.250	1.127	19.770	1.275	22.294	1.465	24.819	1.697	27.345	1.971	29.871	2.286	32.394	2.643	34.913	3.039	37.429	3.476	39.938	3.953	42.441	4.469	44.935	5.024	47.420	5.616	**50**	40 (H)**
45	16.281	1.054	18.803	1.219	21.327	1.430	23.853	1.688	26.379	1.992	28.902	2.341	31.422	2.734	33.937	3.175	36.446	3.658	38.946	4.185	41.437	4.754	43.916	5.366	46.383	6.018	**45**	35 (P)*
40	15.312	0.987	17.835	1.172	20.361	1.410	22.886	1.699	25.410	2.040	27.931	2.431	30.445	2.873	32.952	3.365	35.450	3.905	37.936	4.493	40.409	5.128	42.866	5.808	45.307	6.534	**40**	35 (H) 30 (P)*
35	14.344	0.928	16.868	1.139	19.394	1.410	21.919	1.739	24.439	2.128	26.954	2.573	29.459	3.075	31.952	3.632	34.432	4.244	36.895	4.908	39.339	5.624	41.763	6.390	44.163	7.204	**35**	
33	13.957	0.907	16.482	1.130	19.008	1.417	21.531	1.767	24.049	2.178	26.560	2.649	29.059	3.180	31.545	3.768	34.014	4.413	36.465	5.114	38.893	5.868	41.298	6.673	43.676	7.528	**33**	
30	13.376	0.879	15.902	1.125	18.427	1.440	20.948	1.824	23.462	2.274	25.964	2.790	28.452	3.370	30.922	4.012	33.371	4.715	35.797	5.477	38.195	6.295	40.563	7.167	42.897	8.091	**30**	30 (H)**
25	12.410	0.849	14.935	1.143	17.457	1.520	19.969	1.977	22.468	2.512	24.947	3.123	27.403	3.808	29.831	4.564	32.226	5.388	34.584	6.275	36.901	7.224	39.174	8.229	41.399	9.286	**25**	
23	12.023	0.844	14.548	1.164	17.066	1.572	19.573	2.066	22.061	2.645	24.526	3.305	26.961	4.042	29.362	4.854	31.724	5.737	34.041	6.685	36.310	7.695	38.526	8.761			**23**	25 (P)*
20	11.443	0.849	13.965	1.216	16.476	1.682	18.968	2.247	21.431	2.904	23.864	3.651	26.255	4.481	28.598	5.394	30.898	6.378	33.119	7.429							**20**	25 (H)**
15	10.474	0.912	12.982	1.395	15.461	2.006	17.898	2.738	20.281	3.583	22.598	4.532	24.839	5.572													**15**	20 (P)*
14	10.279	0.937	12.781	1.453	15.248	2.104	17.665	2.882	20.019	3.776	22.296	4.774															**14**	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 22 Degrees

$\Delta = 22°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	525.971	46.901	528.473	46.915	530.976	46.930	533.479	46.945	535.982	46.962	538.485	46.979	540.989	46.998	543.492	47.017	545.996	47.037	548.500	47.057	551.004	47.079	553.508	47.101	556.012	47.125	2500	
2200	467.659	41.300	470.162	41.316	472.666	41.333	475.169	41.351	477.672	41.370	480.176	41.390	482.680	41.411	485.184	41.432	487.688	41.455	490.192	41.479	492.697	41.503	495.201	41.529	497.706	41.555	2200	
2000	428.786	37.569	431.289	37.587	433.792	37.605	436.296	37.625	438.800	37.646	441.304	37.668	443.808	37.690	446.313	37.714	448.817	37.739	451.322	37.765	453.827	37.792	456.332	37.820	458.837	37.849	2000	
1800	389.912	33.841	392.416	33.861	394.920	33.881	397.424	33.903	399.928	33.926	402.432	33.950	404.937	33.976	407.442	34.002	409.947	34.030	412.452	34.059	414.957	34.089	417.463	34.120	419.969	34.152	1800	
1500	331.604	28.256	334.108	28.280	336.613	28.304	339.117	28.331	341.622	28.358	344.127	28.387	346.633	28.418	349.139	28.449	351.645	28.483	354.151	28.517	356.657	28.553	359.164	28.591	361.671	28.630	1500	
1200	273.298	22.687	275.803	22.716	278.309	22.747	280.815	22.779	283.321	22.814	285.827	22.850	288.334	22.888	290.841	22.928	293.348	22.969	295.856	23.013	298.364	23.058	300.872	23.105	303.381	23.153	1200	
1000	234.430	18.989	236.936	19.023	239.443	19.061	241.950	19.100	244.457	19.141	246.965	19.185	249.473	19.230	251.981	19.278	254.490	19.328	256.999	19.380	259.508	19.434	262.018	19.490	264.527	19.549	1000	
900	214.997	17.147	217.504	17.186	220.011	17.227	222.519	17.271	225.027	17.317	227.535	17.365	230.044	17.416	232.553	17.469	235.063	17.524	237.573	17.582	240.083	17.642	242.593	17.704	245.104	17.769	900	
800	195.566	15.313	198.073	15.357	200.581	15.403	203.090	15.452	205.599	15.504	208.108	15.558	210.618	15.615	213.128	15.675	215.639	15.737	218.150	15.802	220.661	15.870	223.173	15.940	225.685	16.013	800	
700	176.136	13.490	178.644	13.540	181.154	13.593	183.663	13.649	186.173	13.708	188.684	13.770	191.195	13.835	193.706	13.904	196.218	13.975	198.730	14.049	201.243	14.126	203.756	14.207	206.269	14.290	700	
600	156.709	11.683	159.219	11.741	161.729	11.803	164.240	11.868	166.751	11.938	169.263	12.010	171.776	12.086	174.289	12.166	176.802	12.249	179.316	12.335	181.831	12.425	184.346	12.519	186.861	12.616	600	
500	137.285	9.902	139.797	9.971	142.309	10.046	144.822	10.125	147.335	10.207	149.849	10.294	152.364	10.385	154.879	10.480	157.394	10.580	159.910	10.684	162.427	10.792	164.944	10.905	167.462	11.021	500	
400	117.868	8.166	120.382	8.253	122.897	8.346	125.412	8.444	127.928	8.547	130.445	8.656	132.962	8.770	135.480	8.889	137.998	9.014	140.517	9.143	143.037	9.278	145.557	9.419	148.077	9.564	400	
360	110.104	7.492	112.620	7.589	115.136	7.693	117.652	7.802	120.170	7.916	122.688	8.037	125.206	8.164	127.725	8.296	130.245	8.434	132.765	8.578	135.286	8.729	137.807	8.884	140.329	9.046	360	100 (P)*
350	108.164	7.327	110.679	7.427	113.196	7.532	115.713	7.645	118.230	7.763	120.749	7.887	123.268	8.017	125.787	8.153	128.307	8.295	130.828	8.444	133.349	8.598	135.871	8.758	138.393	8.925	350	
300	98.463	6.520	100.981	6.636	103.499	6.760	106.018	6.891	108.537	7.029	111.058	7.173	113.579	7.325	116.100	7.484	118.622	7.649	121.145	7.822	123.668	8.002	126.191	8.189	128.715	8.383	300	
250	88.768	5.765	91.288	5.905	93.809	6.053	96.330	6.209	98.852	6.375	101.375	6.548	103.898	6.730	106.421	6.920	108.946	7.119	111.470	7.326	113.995	7.542	116.520	7.766	119.046	7.998	250	
230	84.892	5.485	87.413	5.637	89.935	5.798	92.457	5.968	94.980	6.147	97.504	6.336	100.028	6.533	102.553	6.740	105.077	6.956	107.603	7.181	110.128	7.415	112.654	7.658	115.180	7.910	230	80 (P)*
200	79.082	5.100	81.604	5.274	84.128	5.459	86.652	5.655	89.176	5.861	91.701	6.077	94.226	6.304	96.752	6.542	99.278	6.790	101.804	7.048	104.330	7.317	106.856	7.596	109.381	7.885	200	
170	73.275	4.777	75.800	4.982	78.325	5.199	80.850	5.429	83.376	5.671	85.902	5.925	88.428	6.192	90.954	6.470	93.479	6.761	96.005	7.064	98.530	7.380	101.055	7.707	103.579	8.046	170	
155	70.374	4.650	72.899	4.874	75.425	5.113	77.951	5.364	80.477	5.629	83.003	5.908	85.528	6.200	88.054	6.505	90.579	6.824	93.103	7.155	95.627	7.500	98.150	7.858	100.672	8.230	155	65 (P)*
125	64.575	4.505	67.100	4.783	69.626	5.077	72.152	5.388	74.676	5.716	77.200	6.060	79.723	6.420	82.245	6.797	84.765	7.189	87.284	7.598	89.801	8.023	92.315	8.464	94.828	8.921	125	
100	59.741	4.573	62.265	4.919	64.787	5.285	67.308	5.672	69.827	6.079	72.344	6.506	74.858	6.953	77.369	7.419	79.877	7.906	82.381	8.412	84.882	8.938	87.378	9.483	89.870	10.047	100	
90	57.804	4.682	60.325	5.065	62.844	5.471	65.361	5.899	67.874	6.349	70.385	6.821	72.891	7.316	75.394	7.832	77.892	8.369	80.385	8.928	82.873	9.508	85.356	10.109	87.832	10.731	90	50 (P)*
80	55.862	4.863	58.378	5.292	60.891	5.747	63.400	6.226	65.905	6.730	68.405	7.258	70.900	7.810	73.389	8.386	75.872	8.986	78.348	9.609	80.817	10.256	83.279	10.925	85.732	11.617	80	50 (H)**
70	53.907	5.146	56.415	5.634	58.917	6.150	61.414	6.694	63.904	7.265	66.388	7.863	68.864	8.488	71.331	9.139	73.790	9.816	76.239	10.520	78.679	11.248	81.108	12.002	83.525	12.780	70	
60	51.928	5.579	54.420	6.144	56.904	6.740	59.379	7.367	61.844	8.025	64.299	8.713	66.743	9.431	69.175	10.178	71.593	10.954	73.998	11.758	76.389	12.590	78.765	13.449	81.125	14.334	60	40 (P)*
55	50.921	5.876	53.400	6.488	55.870	7.133	58.328	7.812	60.775	8.523	63.208	9.266	65.627	10.041	68.032	10.847	70.421	11.682	72.793	12.547	75.148	13.440	77.484	14.362	79.802	15.310	55	
50	49.894	6.246	52.356	6.913	54.806	7.617	57.241	8.355	59.661	9.128	62.065	9.935	64.451	10.775	66.819	11.647	69.168	12.551	71.496	13.484	73.803	14.447	76.087	15.439	78.348	16.457	50	40 (H)**
45	48.836	6.712	51.274	7.444	53.695	8.215	56.098	9.024	58.481	9.870	60.844	10.750	63.184	11.666	65.502	12.614	67.795	13.594	70.063	14.606	72.304	15.647	74.518	16.716	76.703	17.812	45	35 (P)*
40	47.729	7.303	50.130	8.114	52.510	8.966	54.866	9.858	57.197	10.787	59.501	11.754	61.776	12.756	64.023	13.791	66.238	14.858	68.422	15.956							40	30 (H)**
35	46.537	8.065	48.894	8.970	51.202	9.918	53.488	10.908	55.741	11.936	57.958	13.001															35	
33	46.024	8.431	48.342	9.379	50.626	10.371	52.875	11.404	55.086	12.475	57.258	13.583															33	30 (P)*
30	45.197	9.063	47.458	10.082	49.679	11.144																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H - Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 23 Degrees

△=23°

R_C	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_C	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	516.131	51.221	518.632	51.224	521.133	51.228	523.634	51.232	526.135	51.238	528.636	51.244	531.137	51.251	533.639	51.260	536.141	51.269	538.642	51.278	541.145	51.289	543.647	51.301	546.149	51.313	2500	
2200	455.096	45.075	457.596	45.079	460.097	45.083	462.598	45.088	465.100	45.095	467.601	45.102	470.103	45.110	472.604	45.119	475.106	45.130	477.608	45.141	480.111	45.153	482.614	45.166	485.116	45.180	2200	
2000	414.405	40.979	416.906	40.982	419.407	40.987	421.908	40.993	424.410	41.000	426.911	41.008	429.413	41.017	431.915	41.027	434.417	41.038	436.919	41.050	439.422	41.064	441.925	41.078	444.428	41.093	2000	
1800	373.715	36.882	376.216	36.886	378.717	36.891	381.218	36.897	383.720	36.905	386.221	36.914	388.723	36.924	391.225	36.935	393.728	36.948	396.231	36.961	398.734	36.976	401.237	36.992	403.740	37.009	1800	
1500	312.679	30.737	315.180	30.742	317.682	30.748	320.183	30.756	322.685	30.765	325.187	30.776	327.689	30.788	330.192	30.801	332.695	30.816	335.198	30.832	337.702	30.850	340.205	30.869	342.709	30.890	1500	
1200	251.644	24.592	254.145	24.598	256.647	24.606	259.149	24.616	261.651	24.627	264.154	24.641	266.657	24.656	269.160	24.673	271.664	24.691	274.167	24.712	276.672	24.734	279.176	24.758	281.681	24.783	1200	
1000	210.954	20.496	213.456	20.504	215.957	20.513	218.460	20.525	220.962	20.539	223.465	20.555	225.969	20.573	228.473	20.593	230.977	20.615	233.482	20.640	235.987	20.667	238.492	20.695	240.998	20.726	1000	
900	190.609	18.449	193.111	18.457	195.613	18.468	198.115	18.481	200.618	18.496	203.122	18.514	205.626	18.534	208.130	18.556	210.635	18.581	213.140	18.608	215.645	18.638	218.151	18.670	220.658	18.704	900	
800	170.264	16.401	172.766	16.411	175.268	16.423	177.771	16.437	180.274	16.455	182.778	16.474	185.283	16.497	187.787	16.522	190.293	16.550	192.798	16.581	195.305	16.614	197.811	16.650	200.319	16.688	800	
700	149.919	14.354	152.421	14.365	154.924	14.379	157.427	14.395	159.931	14.415	162.435	14.438	164.940	14.464	167.446	14.492	169.952	14.524	172.458	14.560	174.965	14.597	177.473	14.638	179.981	14.682	700	100 (P)*
600	129.574	12.308	132.077	12.321	134.580	12.336	137.084	12.356	139.588	12.379	142.093	12.406	144.599	12.436	147.105	12.469	149.612	12.506	152.120	12.547	154.628	12.592	157.137	12.639	159.646	12.691	600	
500	109.230	10.263	111.733	10.278	114.236	10.296	116.741	10.320	119.246	10.348	121.752	10.379	124.259	10.416	126.766	10.456	129.275	10.500	131.784	10.550	134.293	10.603	136.803	10.660	139.314	10.722	500	
400	88.886	8.219	91.389	8.237	93.894	8.261	96.399	8.290	98.906	8.325	101.413	8.365	103.921	8.410	106.431	8.460	108.941	8.516	111.452	8.577	113.963	8.644	116.476	8.715	118.989	8.792	400	
360	80.748	7.402	83.252	7.423	85.757	7.449	88.263	7.482	90.770	7.520	93.278	7.564	95.788	7.615	98.298	7.670	100.809	7.732	103.321	7.800	105.833	7.874	108.347	7.954	110.862	8.040	360	
350	78.714	7.198	81.218	7.219	83.723	7.246	86.229	7.280	88.736	7.319	91.245	7.365	93.754	7.416	96.265	7.474	98.776	7.538	101.288	7.608	103.801	7.684	106.315	7.765	108.830	7.854	350	80 (P)*
300	68.542	6.178	71.047	6.203	73.553	6.235	76.060	6.274	78.568	6.320	81.078	6.373	83.589	6.433	86.100	6.500	88.613	6.574	91.127	6.656	93.642	6.745	96.158	6.840	98.675	6.943	300	
250	58.370	5.160	60.876	5.190	63.383	5.228	65.892	5.275	68.402	5.330	70.913	5.394	73.426	5.466	75.939	5.547	78.454	5.636	80.971	5.734	83.488	5.840	86.006	5.955	88.526	6.078	250	
230	54.302	4.764	56.808	4.786	59.316	4.828	61.825	4.878	64.336	4.938	66.848	5.008	69.361	5.086	71.876	5.174	74.392	5.271	76.910	5.377	79.428	5.492	81.947	5.617	84.468	5.751	230	
200	48.200	4.145	50.707	4.182	53.215	4.230	55.726	4.289	58.238	4.358	60.752	4.437	63.267	4.528	65.783	4.629	68.301	4.740	70.820	4.862	73.341	4.995	75.862	5.138	78.385	5.292	200	
170	42.098	3.539	44.606	3.583	47.116	3.639	49.628	3.708	52.142	3.789	54.657	3.883	57.175	3.989	59.693	4.108	62.214	4.239	64.735	4.382	67.258	4.538	69.781	4.706	72.306	4.887	170	65 (P)*
155	39.047	3.237	41.556	3.285	44.067	3.347	46.580	3.422	49.095	3.511	51.611	3.614	54.130	3.731	56.650	3.861	59.172	4.004	61.694	4.162	64.218	4.333	66.743	4.617	69.269	4.715	155	
125	32.946	2.637	35.457	2.697	37.970	2.773	40.485	2.867	43.003	2.977	45.523	3.105	48.044	3.249	50.568	3.410	53.092	3.588	55.618	3.783	58.144	3.995	60.672	4.223	63.200	4.468	125	
100	27.863	2.144	30.376	2.219	32.892	2.314	35.410	2.431	37.931	2.569	40.454	2.728	42.979	2.908	45.505	3.109	48.032	3.331	50.560	3.575	53.088	3.838	55.616	4.123	58.145	4.428	100	
90	25.830	1.950	28.344	2.033	30.861	2.139	33.382	2.269	35.904	2.422	38.428	2.598	40.954	2.798	43.481	3.022	46.009	3.268	48.538	3.538	51.066	3.831	53.594	4.146	56.121	4.485	90	50 (P)*
80	23.798	1.758	26.313	1.851	28.832	1.971	31.354	2.117	33.878	2.289	36.404	2.487	38.931	2.712	41.459	2.963	43.987	3.240	46.516	3.543	49.043	3.871	51.570	4.226	54.095	4.605	80	50 (H)**
70	21.766	1.571	24.283	1.677	26.804	1.815	29.328	1.980	31.853	2.177	34.381	2.403	36.909	2.660	39.437	2.946	41.965	3.261	44.492	3.607	47.017	3.981	49.540	4.384	52.060	4.816	70	
60	19.735	1.389	22.254	1.512	24.777	1.671	27.303	1.866	29.830	2.095	32.358	2.359	34.887	2.657	37.414	2.990	39.940	3.357	42.463	3.758	44.983	4.192	47.498	4.660	50.008	5.160	60	40 (P)*
55	18.720	1.301	21.240	1.436	23.765	1.609	26.291	1.821	28.819	2.070	31.347	2.358	33.875	2.683	36.401	3.045	38.924	3.445	41.444	3.881	43.958	4.353	46.467	4.861	48.969	5.404	55	
50	17.705	1.216	20.227	1.364	22.752	1.555	25.280	1.787	27.808	2.062	30.336	2.377	32.862	2.734	35.386	3.131	37.905	3.569	40.419	4.047	42.926	4.564	45.425	5.119	47.915	5.713	50	40 (H)**
45	16.691	1.134	19.214	1.299	21.741	1.511	24.269	1.769	26.797	2.073	29.324	2.423	31.847	2.818	34.366	3.258	36.879	3.742	39.384	4.270	41.880	4.841	44.365	5.453	46.838	6.107	45	35 (P)*
40	15.677	1.058	18.202	1.244	20.730	1.482	23.258	1.771	25.785	2.113	28.309	2.505	30.827	2.948	33.339	3.440	35.841	3.981	38.332	4.570	40.810	5.206	43.274	5.888	45.721	6.615	40	35 (H) 30 (P)*
35	14.664	0.990	17.160	1.202	19.719	1.473	22.246	1.803	24.770	2.192	27.288	2.638	29.798	3.141	32.296	3.699	34.781	4.312	37.250	4.978	39.701	5.695	42.131	6.462	44.539	7.277	35	
33	14.259	0.965	16.786	1.190	19.314	1.477	21.841	1.827	24.363	2.239	26.877	2.711	29.381	3.242	31.872	3.832	34.348	4.479	36.804	5.180	39.240	5.935	41.651	6.742	44.037	7.599	33	
30	13.651	0.933	16.179	1.179	18.707	1.495	21.231	1.879	23.749	2.330	26.256	2.847	28.749	3.428	31.225	4.071	33.681	4.776	36.113	5.539	38.518	6.358	40.894	7.232	43.237	8.157	30	30 (H)**
25	12.640	0.894	15.168	1.189	17.693	1.566	20.209	2.023	22.713	2.560	25.197	3.172	27.659	3.858	30.094	4.616	32.496	5.440	34.862	6.330	37.188	7.280	39.470	8.286	41.704	9.346	25	
23	12.236	0.886	14.763	1.206	17.285	1.615	19.796	2.110	22.289	2.690	24.760	3.351	27.202	4.089	29.610	4.903	31.979	5.787	34.305	6.736	36.583	7.748	38.809	8.816			23	25 (P)*
20	11.629	0.886	14.154	1.253	16.669	1.720	19.166	2.285	21.637	2.944	24.075	3.692	26.473	4.525	28.824	5.438	31.123	6.424	33.363	7.477							20	25 (H)**
15	10.616	0.939	13.128	1.423	15.613	2.036	18.056	2.769	20.447	3.616	22.772	4.565	25.023	5.608													15	20 (P)*
14	10.412	0.963	12.918	1.480	15.391	2.132	17.815	2.911	20.177	3.806	22.464	4.807															14	20 (H)**

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 23 Degrees

△=23°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	548.652	51.326	551.155	51.340	553.657	51.355	556.161	51.371	558.664	51.387	561.167	51.405	563.670	51.423	566.174	51.442	568.678	51.462	571.182	51.483	573.686	51.505	576.190	51.527	578.695	51.551	2500	
2200	487.619	45.195	490.122	45.210	492.625	45.228	495.129	45.245	497.633	45.264	500.136	45.284	502.640	45.305	505.145	45.327	507.649	45.349	510.153	45.373	512.658	45.398	515.163	45.423	517.668	45.450	2200	
2000	446.931	41.110	449.434	41.127	451.938	41.146	454.442	41.166	456.946	41.186	459.450	41.208	461.954	41.231	464.459	41.255	466.964	41.280	469.469	41.306	471.974	41.333	474.479	41.361	476.984	41.390	2000	
1800	406.243	37.028	408.747	37.047	411.251	37.068	413.755	37.090	416.260	37.113	418.764	37.137	421.269	37.162	423.774	37.189	426.280	37.216	428.785	37.245	431.291	37.275	433.797	37.307	436.303	37.339	1800	
1500	345.213	30.912	347.718	30.933	350.223	30.960	352.728	30.986	355.233	31.014	357.738	31.043	360.244	31.073	362.750	31.105	365.256	31.138	367.763	31.173	370.270	31.209	372.777	31.247	375.284	31.286	1500	
1200	284.186	24.811	286.692	24.840	289.198	24.871	291.704	24.904	294.210	24.938	296.717	24.975	299.224	25.013	301.732	25.053	304.239	25.094	306.747	25.138	309.256	25.183	311.764	25.230	314.273	25.279	1200	
1000	243.504	20.759	246.011	20.794	248.518	20.831	251.025	20.871	253.533	20.912	256.041	20.956	258.549	21.001	261.058	21.049	263.567	21.099	266.076	21.151	268.586	21 205	271.096	21.262	273.607	21.320	1000	
900	223.165	18.741	225.672	18.780	228.179	18.821	230.688	18.865	233.196	18.910	235.705	18.959	238.214	19.010	240.724	19.063	243.234	19.118	245.744	19.176	248.255	19.236	250.766	19.299	253.277	19.364	900	
800	202.826	16.729	205.334	16.773	207.843	16.820	210.352	16.869	212.861	16.921	215.371	16.975	217.881	17.032	220.392	17.092	222.903	17.155	225.415	17.220	227.926	17.287	230.439	17.358	232.951	17.431	800	
700	182.490	14.729	184.999	14.780	187.508	14.833	190.019	14.889	192.529	14.948	195.040	15.010	197.552	15.075	200.064	15.144	202.576	15.215	205.089	15.290	207.602	15.367	210.116	15.448	212.630	15.531	700	
600	162.156	12.746	164.666	12.804	167.177	12.866	169.689	12.932	172.201	13.001	174.714	13.073	177.227	13.149	179.741	13.229	182.255	13.312	184.769	13.399	187.285	13.489	189.800	13.583	192.316	13.680	600	
500	141.826	10.788	144.338	10.858	146.851	10.932	149.365	11.011	151.879	11.094	154.394	11.181	156.909	11.272	159.425	11.367	161.941	11.468	164.458	11.571	166.976	11.680	169.494	11.792	172.012	11.909	500	
400	121.503	8.875	124.018	8.962	126.533	9.055	129.050	9.154	131.567	9.257	134.084	9.366	136.602	9.480	139.121	9.600	141.641	9.724	144.161	9.854	146.682	9.990	149.203	10.130	151.724	10.276	400	
360	113.377	8.131	115.893	8.228	118.410	8.332	120.928	8.441	123.446	8.555	125.965	8.677	128.485	8.803	131.005	8.936	133.526	9.074	136.048	9.219	138.570	9.369	141.092	9.525	143.616	9.687	360	100 (P)*
350	111.346	7.948	113.862	8.048	116.380	8.154	118.898	8.266	121.416	8.385	123.936	8.509	126.456	8.639	128.977	8 776	131.498	8.918	134.020	9.066	136.542	9.221	139.065	9.382	141.589	9.548	350	
300	101.193	7.053	103.711	7.169	106.231	7.293	108.751	7.424	111.272	7.562	113.793	7.707	116.316	7.859	118.839	8.018	121.362	8.184	123.886	8.357	126.411	8.537	128.936	8.724	131.462	8.919	300	
250	91.046	6.209	93.567	6.349	96.089	6.498	98.612	6.655	101.135	6.820	103.659	6.994	106.184	7.176	108.709	7.367	111.235	7.566	113.762	7.773	116.289	7.989	118.816	8.213	121.343	8.446	250	
230	86.989	5.894	89.512	6.046	92.035	6.207	94.559	6.378	97.083	6.558	99.609	6.746	102.134	6.944	104.661	7.151	107.188	7.368	109.715	7.593	112.242	7.827	114.770	8.071	117.298	8.323	230	80 (P)*
200	80.908	5.456	83.432	5.631	85.957	5.816	88.483	6.012	91.009	6.219	93.536	6.436	96.064	6.663	98.591	6.901	101.119	7.149	103.648	7.408	106.176	7.677	108.704	7.956	111.233	8.246	200	
170	74.832	5.080	77.358	5.286	79.885	5.504	82.412	5.734	84.940	5.976	87.468	6.231	89.997	6.498	92.525	6.777	95.053	7.068	97.582	7.372	100.110	7.688	102.637	8.016	105.165	8.356	170	
155	71.796	4.927	74.323	5.152	76.851	5.391	79.379	5.643	81.907	5.909	84.435	6.188	86.964	6.480	89.492	6.786	92.020	7.105	94.547	7.437	97.074	7.783	99.601	8.141	102.126	8.513	155	65 (P)*
125	65.728	4.730	68.256	5.008	70.785	5.303	73.313	5.615	75.840	5.943	78.367	6.288	80.893	6.648	83.418	7.026	85.942	7.419	88.465	7.829	90.985	8.254	93.504	8.696	96.021	9.154	125	
100	60.672	4.754	63.199	5.101	65.725	5.468	68.249	5.855	70.772	6.263	73.292	6.691	75.810	7.138	78.325	7.606	80.838	8.093	83.346	8.601	85.852	9.127	88.353	9.673	90.850	10.238	100	
90	58.647	4.846	61.172	5.230	63.694	5.637	66.215	6.065	68.732	6.517	71.247	6.990	73.758	7.485	76.265	8.002	78.768	8.540	81.266	9.100	83.759	9.681	86.247	10.283	88.729	10.906	90	50 (P)*
80	56.617	5.010	59.137	5.441	61.654	5.896	64.168	6.376	66.677	6.880	69.182	7.409	71.682	7.963	74.176	8.540	76.664	9.141	79.146	9.765	81.621	10.413	84.089	11.083	86.548	11.776	80	50 (H)**
70	54.576	5.277	57.088	5.765	59.595	6.282	62.097	6.827	64.592	7.399	67.081	7.998	69.563	8.624	72.036	9.277	74.501	9.955	76 956	10.660	79.402	11 389	81.838	12.144	84.263	12.923	70	
60	52.512	5.693	55.009	6.259	57.498	6.855	59.979	7.484	62.450	8.143	64.911	8.832	67.361	9.551	69.799	10.300	72.225	11.077	74.637	11 883	77 036	12.716	79.419	13.576	81.787	14 463	60	40 (P)*
55	51.463	5.982	53.948	6.595	56.423	7.241	58.888	7.921	61.340	8.634	63.780	9.378	66.206	10.154	68.618	10.961	71.014	11.798	73.394	12.664	75.757	13.559	78.102	14.482	80.428	15.432	55	
50	50.395	6.344	52.863	7.012	55.319	7.717	57.761	8.457	60.188	9 231	62.599	10.039	64.992	10.881	67.368	11.754	69.725	12.659	72.061	13.594	74 376	14.559	76 670	15.552	78.940	46.573	50	40 (H)**
45	49.297	6.801	51.741	7.535	54.169	8.308	56.579	9.118	58.970	9.965	61.340	10.847	63.689	11.764	66.015	12.714	68 317	13.696	70.594	14.709	72.844	15.752	75.068	16.823	77.263	17.921	45	35 (P)*
40	48.150	7.385	50.559	8.197	52.946	9.051	55.310	9.944	57.649	10.876	59.962	11 844	62.246	12.847	64.502	13 884	66.727	14.954	68.920	16.053							40	30 (H)**
35	46.921	8.139	49.276	9.046	51.602	9.996	53.897	10.987	56.159	12.018	58.386	13.084															35	
33	46.393	8.503	48.719	9.453	51.012	10.446	53.270	11.481	55.491	12.554																	33	30 (P)*
30	45.545	9.131	47.815	10.151	50.045	11.215																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 24 Degrees

$\Delta = 24°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	538.892	55.856	541.392	55.859	543.893	55.863	546.394	55.867	548.896	55.873	551.397	55.879	553.898	55.886	556.400	55.895	558.902	55.904	561.404	55.913	563.906	55.924	566.408	55.936	568.911	55.948	2500	
2200	475.125	49.154	477.626	49.157	480.127	49.162	482.628	49.167	485.129	49.173	487.631	49.181	490.132	49.189	492.634	49.198	495.136	49.208	497.638	49.219	500.141	49.232	502.644	49.245	505.146	49.259	2200	
2000	432.614	44.686	435.115	44.690	437.615	44.695	440.117	44.701	442.618	44.708	445.120	44.716	447.622	44.725	450.124	44.735	452.626	44.746	455.128	44.758	457.631	44.772	460.134	44.786	462.637	44.801	2000	
1800	390.103	40.219	392.604	40.223	395.105	40.228	397.606	40.235	400.108	40.242	402.609	40.251	405.112	40.261	407.614	40.272	410.116	40.285	412.619	40.299	415.122	40.313	417.625	40.329	420.129	40.346	1800	
1500	326.336	33.518	328.837	33.523	331.338	33.529	333.840	33.537	336.342	33.546	338.844	33.557	341.346	33.569	343.849	33.582	346.352	33.597	348.855	33.614	351.359	33.631	353.863	33.650	356.367	33.671	1500	
1200	262.569	26.817	265.071	26.823	267.572	26.831	270.074	26.841	272.577	26.852	275.079	26.866	277.583	26.881	280.086	26.898	282.590	26.916	285.094	26.937	287.598	26.959	290.103	26.983	292.608	27.009	1200	
1000	220.058	22.350	222.560	22.358	225.062	22.367	227.564	22.379	230.067	22.393	232.570	22.409	235.074	22.427	237.578	22.447	240.083	22.469	242.587	22.494	245.093	22.521	247.598	22.549	250.104	22.580	1000	
900	198.803	20.117	201.305	20.126	203.807	20.136	206.310	20.149	208.813	20.165	211.316	20.182	213.820	20.203	216.325	20.225	218.830	20.250	221.335	20.277	223.841	20.307	226.347	20.339	228.854	20.373	900	
800	177.548	17.885	180.049	17.894	182.552	17.906	185.055	17.921	187.558	17.938	190.062	17.958	192.567	17.980	195.072	18.006	197.578	18.034	200.084	18.064	202.590	18.097	205.097	18.134	207.605	18.172	800	
700	156.292	15.652	158.795	15.663	161.297	15.677	163.801	15.693	166.305	15.713	168.809	15.736	171.314	15.762	173.820	15.791	176.326	15.823	178.833	15.858	181.341	15.896	183.849	15.937	186.357	15.981	700	100 (P)*
600	135.037	13.420	137.540	13.433	140.043	13.449	142.547	13.468	145.051	13.491	147.557	13.518	150.063	13.548	152.569	13.582	155.077	13.619	157.584	13.660	160.093	13.705	162.602	13.752	165.112	13.804	600	
500	113.782	11.190	116.285	11.205	118.789	11.224	121.294	11.247	123.799	11.275	126.305	11.307	128.813	11.343	131.320	11.383	133.829	11.428	136.338	11.477	138.848	11.530	141.359	11.588	143.871	11.650	500	
400	92.527	8.960	95.031	8.979	97.536	9.003	100.042	9.032	102.549	9.067	105.056	9.107	107.565	9.152	110.075	9.203	112.585	9.258	115.097	9.320	117.609	9.386	120.122	9.458	122.636	9.535	400	
360	84.026	8.069	86.530	8.090	89.035	8.116	91.542	8.149	94.049	8.188	96.558	8.232	99.067	8.282	101.578	8.338	104.089	8.401	106.602	8.469	109.115	8.542	111.630	8.622	114.145	8.708	360	
350	81.900	7.847	84.405	7.868	86.910	7.896	89.417	7.928	91.924	7.968	94.433	8.014	96.943	8.066	99.454	8.124	101.966	8.188	104.478	8.257	106.992	8.333	109.507	8.415	112.023	8.504	350	
300	71.273	6.734	73.778	6.759	76.285	6.791	78.792	6.830	81.301	6.876	83.811	6.929	86.322	6.990	88.835	7.057	91.348	7.132	93.863	7.213	96.379	7.302	98.896	7.398	101.413	7.500	300	80 (P)*
250	60.647	5.624	63.153	5.653	65.660	5.692	68.169	5.739	70.680	5.794	73.191	5.858	75.705	5.930	78.219	6.011	80.735	6.100	83.252	6.198	85.770	6.305	88.290	6.419	90.810	6.543	250	
230	56.396	5.180	58.903	5.212	61.411	5.254	63.921	5.305	66.432	5.365	68.945	5.435	71.459	5.513	73.974	5.601	76.491	5.698	79.010	5.805	81.529	5.920	84.050	6.045	86.571	6.179	230	
200	50.021	4.516	52.528	4.553	55.037	4.601	57.548	4.660	60.061	4.729	62.575	4.809	65.091	4.899	67.609	5.000	70.128	5.112	72.648	5.234	75.170	5.367	77.692	5.511	80.216	5.665	200	
170	43.646	3.854	46.154	3.898	48.665	3.954	51.178	4.023	53.692	4.105	56.209	4.199	58.727	4.305	61.247	4.424	63.768	4.555	66.291	4.699	68.815	4.855	71.340	5.024	73.866	5.205	170	65 (P)*
155	40.459	3.525	42.968	3.573	45.479	3.635	47.993	3.710	50.509	3.799	53.027	3.902	55.546	4.019	58.067	4.149	60.590	4.293	63.114	4.451	65.640	4.622	68.166	4.807	70.694	5.005	155	
125	34.085	2.869	36.596	2.929	39.110	3.006	41.626	3.094	44.145	3.210	46.666	3.337	49.189	3.482	51.713	3.643	54.239	3.822	56.767	4.017	59.295	4.229	61.824	4.458	64.355	4.703	125	
100	28.774	2.336	31.288	2.404	33.804	2.500	36.324	2.617	38.846	2.755	41.370	2.915	43.897	3.095	46.425	3.297	48.954	3.519	51.484	3.763	54.014	4.027	56.545	4.312	59.076	4.618	100	
90	26.650	2.117	29.165	2.200	31.684	2.306	34.205	2.436	36.728	2.590	39.254	2.767	41.782	2.967	44.311	3.191	46.841	3.438	49.372	3.708	51.903	4.001	54.434	4.317	56.964	4.657	90	50 (P)*
80	24.527	1.907	27.044	2.000	29.563	2.120	32.086	2.266	34.612	2.438	37.140	2.637	39.669	2.862	42.199	3.114	44.730	3.391	47.261	3.695	49.792	4.024	52.321	4.379	54.849	4.759	80	50 (H)**
70	22.405	1.701	24.923	1.807	27.445	1.944	29.970	2.111	32.497	2.308	35.027	2.535	37.557	2.792	40.088	3.078	42.619	3.395	45.149	3.740	47.677	4.115	50.204	4.519	52.727	4.952	70	
60	20.283	1.500	22.803	1.624	25.327	1.783	27.853	1.978	30.384	2.208	32.915	2.472	35.446	2.771	37.976	3.104	40.505	3.472	43.032	3.874	45.555	4.309	48.075	4.777	50.589	5.279	60	40 (P)*
55	19.222	1.403	21.744	1.538	24.270	1.712	26.798	1.924	29.328	2.174	31.859	2.462	34.390	2.788	36.919	3.151	39.446	3.551	41.969	3.988	44.488	4.360	47.001	4.969	49.508	5.514	55	
50	18.162	1.309	20.685	1.457	23.212	1.648	25.742	1.881	28.273	2.156	30.803	2.472	33.333	2.830	35.860	3.228	38.383	3.667	40.901	4.145	43.413	4.663	45.917	5.219	48.412	5.814	50	40 (H)**
45	17.102	1.218	19.627	1.383	22.156	1.595	24.686	1.854	27.217	2.159	29.747	2.509	32.274	2.905	34.797	3.346	37.314	3.831	39.823	4.360	42.324	4.931	44.815	5.545	47.294	6.200	45	35 (P)*
40	16.043	1.133	18.570	1.319	21.100	1.557	23.630	1.847	26.161	2.189	28.688	2.582	31.210	3.026	33.726	3.518	36.233	4.061	38.730	4.651	41.213	5.288	43.684	5.971	46.137	6.699	40	33 (H) 30 (P)*
35	14.985	1.055	17.513	1.267	20.044	1.539	22.574	1.870	25.102	2.260	27.624	2.707	30.138	3.210	32.641	3.770	35.132	4.383	37.607	5.050	40.064	5.769	42.501	6.537	44.916	7.354	35	
33	14.562	1.027	17.091	1.252	19.622	1.540	22.151	1.890	24.677	2.303	27.196	2.776	29.705	3.308	32.201	3.899	34.682	4.547	37.145	5.249	39.587	6.006	42.006	6.814	44.399	7.672	33	
30	13.927	0.989	16.457	1.236	18.988	1.552	21.516	1.937	24.037	2.389	26.549	2.906	29.047	3.488	31.529	4.133	33.991	4.839	36.430	5.603	38.842	6.424	41.226	7.299	43.577	8.226	30	30 (H)**
25	12.871	0.941	15.402	1.236	17.930	1.614	20.450	2.072	22.958	2.610	25.449	3.223	27.917	3.911	30.358	4.669	32.768	5.496	35.142	6.387	37.476	7.338	39.767	8.347	42.011	9.408	25	
23	12.449	0.929	14.979	1.250	17.505	1.659	20.020	2.156	22.519	2.736	24.995	3.398	27.443	4.139	29.859	4.953	32.236	5.839	34.571	6.790	36.857	7.804	39.093	8.874			23	25 (P)*
20	11.815	0.924	14.344	1.291	16.863	1.760	19.365	2.326	21.842	2.986	24.286	3.735	26.692	4.570	29.051	5.484	31.359	6.472	33.609	7.527							20	25 (H)**
15	10.758	0.968	13.274	1.453	15.765	2.067	18.215	2.802	20.613	3.650	22.947	4.601	25.206	5.645													15	20 (P)*
14	10.545	0.990	13.057	1.508	15.535	2.161	17.966	2.942	20.336	3.839	22.631	4.841															14	20 (H)**

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 24 Degrees

$\Delta = 24^c$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	571.414	55.961	573.916	55.975	576.419	55.990	578.923	56.006	581.426	56.022	583.929	56.040	586.433	56.058	588.937	56.077	591.441	56.097	593.945	56.118	596.449	56.140	598.954	56.162	601.459	56.186	2500	
2200	507.649	49.273	510.153	49.290	512.656	49.306	515.160	49.324	517.664	49.344	520.167	49.363	522.672	49.384	525.176	49.406	527.681	49.428	530.185	49.452	532.690	49.477	535.195	49.503	537.701	49.529	2200	
2000	465.141	44.818	467.644	44.835	470.148	44.854	472.652	44.874	475.156	44.895	477.660	44.917	480.165	44.939	482.670	44.963	485.175	44.988	487.680	45.014	490.186	45.042	492.691	45.070	495.197	45.099	2000	
1800	422.632	40.365	425.136	40.384	427.640	40.405	430.145	40.427	432.649	40.450	435.154	40.474	437.659	40.500	440.165	40.526	442.670	40.554	445.176	40.583	447.682	40.613	450.188	40.645	452.695	40.677	1800	
1500	358.871	33.693	361.376	33.716	363.881	33.741	366.386	33.768	368.892	33.795	371.397	33.824	373.904	33.855	376.410	33.887	378.917	33.920	381.423	33.955	383.930	33.991	386.438	34.029	388.945	34.068	1500	
1200	295.114	27.036	297.619	27.065	300.125	27.096	302.632	27.129	305.139	27.164	307.646	27.200	310.153	27.239	312.661	27.278	315.169	27.320	317.677	27.364	320.186	27.409	322.695	27.456	325.204	27.505	1200	
1000	252.611	22.613	255.118	22.648	257.625	22.686	260.133	22.725	262.641	22.767	265.149	22.810	267.658	22.856	270.167	22.904	272.677	22.954	275.187	23.006	277.697	23.061	280.208	23.117	282 719	23.176	1000	
900	231.361	20.410	233.869	20.449	236.377	20.490	238.885	20.534	241.394	20.580	243.903	20.628	246.413	20.679	248.923	20.732	251.434	20.788	253.944	20.846	256.456	20.906	258.968	20.969	261.479	21.034	900	
800	210.113	18.213	212.621	18.257	215.130	18.304	217.639	18.353	220.149	18.405	222.660	18.460	225.170	18.517	227.682	18.577	230.193	18.639	232.705	18.705	235.218	18.772	237.731	18.843	240.244	18.916	800	
700	188.866	16.028	191.376	16.078	193.886	16.132	196.396	16.188	198.908	16.247	201.419	16.309	203.931	16.375	206.444	16.443	208.957	16.515	211.471	16.589	213.985	16.667	216.499	16.747	219.014	16.831	700	
600	167.622	13.859	170.133	13.917	172.645	13.979	175.157	14.045	177.670	14.114	180.183	14.187	182.697	14.263	185.211	14.343	187.726	14.427	190.242	14.513	192.758	14.604	195.274	14.698	197.791	14.795	600	
500	146.383	11 716	148.896	11.786	151.410	11.860	153.924	11.939	156.439	12.022	158.954	12.109	161.470	12.201	163.987	12.297	166.504	12.397	169.022	12.501	171.541	12.609	174.060	12.722	176.579	12.839	500	
400	125.151	9.618	127.666	9.705	130.183	9.798	132.700	9.897	135.218	10.000	137.736	10.110	140.256	10.224	142.776	10.344	145.296	10.469	147.817	10.599	150.339	10.734	152.862	10.875	155.385	11.021	400	
360	116.661	8.800	119.178	8.897	121.696	9.001	124.215	9.110	126.734	9.225	129.254	9.346	131.775	9.473	134.297	9.606	136.819	9.745	139.342	9.889	141.865	10.040	144.389	10.197	146.914	10.359	360	100 (P)*
350	114.539	8.598	117.057	8.698	119.575	8.804	122.094	8.917	124.614	9.036	127.134	9.160	129.655	9.291	132.177	9.427	134.700	9.570	137.223	9.719	139.747	9.874	142.272	10.034	144.797	10.201	350	
300	103.932	7.611	106.452	7.727	108.972	7.851	111.493	7.983	114.016	8.121	116.538	8.266	119.062	8.418	121.587	8.578	124.112	8.744	126.637	8.917	129.163	9.098	131.690	9.285	134.218	9.480	300	
250	93.332	6.675	95.854	6.815	98.377	6.964	100.901	7.121	103.426	7.287	105.952	7.461	108.478	7.643	111.005	7.834	113.533	8.034	116.061	8.242	118.590	8.458	121.119	8.682	123.649	8.916	250	
230	89.094	6.322	91.618	6.475	94.142	6.637	96.668	6.807	99.194	6.987	101.721	7.176	104.248	7.375	106.777	7.582	109.305	7.799	111.835	8.025	114.364	8.259	116.894	8.503	119.425	8.756	230	80 (P)*
200	82.741	5.829	85.267	6.005	87.793	6.190	90.321	6.386	92.849	6.593	95.378	6.811	97.907	7.038	100.437	7.277	102.967	7.525	105.498	7.785	108.029	8.054	110.560	8.334	113.091	8.624	200	
170	76.394	5.398	78.922	5.604	81.451	5.823	83.980	6.053	86.510	6 296	89.041	6.551	91.571	6.819	94.102	7.098	96.633	7.390	99.164	7.694	101.695	8.011	104.226	8.339	106.756	8.680	170	
155	73.222	5.217	75.752	5.443	78.282	5.682	80.812	5.935	83.343	6.201	85.873	6.480	88.404	6.773	90.935	7.080	93.466	7.399	95.997	7.732	98.527	8.078	101.056	8.438	103.585	8.810	155	65 (P)*
125	66.885	4.966	69.416	5.245	71.947	5.540	74.478	5.852	77.009	6:181	79.539	6.526	82.068	6.888	84.596	7.266	87.124	7.660	89.650	8.070	92.174	8.496	94.697	8.939	97.217	9.398	125	
100	61.607	4.945	64.137	5.292	66.666	5.660	69.194	6.048	71.720	6.456	74.244	6.885	76.766	7.333	79.285	7.802	81.802	8.290	84.315	8.798	86.825	9.325	89.331	9.872	91.834	10.439	100	
90	59.494	5.019	62.021	5.403	64.548	5.810	67.072	6.240	69.593	6.692	72.112	7.166	74.627	7.662	77.139	8.180	79.647	8.719	82.150	9.280	84.649	9.862	87.142	10.465	89.630	11.090	90	50 (P)*
80	57.376	5.165	59.900	5.596	62.421	6.052	64.938	6.533	67.452	7.038	69.962	7.568	72.466	8.122	74.966	8.701	77.459	9.303	79.947	9.928	82.428	10.577	84.901	11.248	87.367	11.943	80	50 (H)**
70	55.248	5.413	57.764	5.903	60.276	6.421	62.782	6.966	65.283	7.540	67.777	8.140	70.264	8.767	72.743	9.421	75.214	10.100	77.676	10.806	80.128	11.537	82.571	12.293	85.002	13.074	70	
60	53.098	5.813	55.600	6.379	58.095	6.977	60.581	7.606	63.058	8.267	65.525	8.957	67.982	9.678	70.427	10.428	72.859	11.206	75.279	12.013	77.684	12.848	80.076	13.710	82.451	14.598	60	40 (P)*
55	52.007	6.093	54.498	6.707	56.979	7.354	59.449	8.035	61.908	8.749	64.354	9.495	66.788	10.273	69.207	11.081	71.610	11.919	73.998	12.787	76.369	13.684	78.722	14.608	81.056	15.560	55	
50	50.898	6.447	53.372	7.116	55.834	7.822	58.282	8.563	60.716	9.339	63.134	10.148	65.536	10.991	67.919	11.867	70.284	12.773	72.628	13.710	74.952	14.676	77.255	15.671	79.534	16.694	50	40 (H)**
45	49.759	6.896	52.210	7.631	54.644	8.405	57.062	9.216	59.460	10.065	61.838	10.949	64.196	11.867	66.530	12.819	68.841	13.803	71.127	14.818	73.386	15.862	75.619	16.935	77.824	18.035	45	35 (P)*
40	48.573	7.471	50.989	8.285	53.384	9.140	55.756	10.035	58.103	10.968	60.424	11.938	62.718	12.943	64.983	13.982	67.217	15.054	69.420	16.155							40	30 (H)**
35	47.306	8.218	49.669	9.126	52.003	10.078	54.307	11.071	56.578	12.103	58.815	13.172															35	
33	46.764	8.578	49.098	9.530	51.400	10.525	53.667	11.562	55.897	12.637																	33	30 (P)*
30	45.894	9.202	48.173	10.224	50.413	11.290																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=25°

Deviation Angle = 25 Degr.

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_O	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	561.737	60.703	564.238	60.706	566.739	60.710	569.240	60.714	571.741	60.720	574.242	60.726	576.744	60.733	579.246	60.742	581.748	60.751	584.250	60.760	586.752	60.771	589.254	60.783	591.757	60.795	2500	
2200	495.229	53.419	497.730	53.423	500.230	53.427	502.732	53.433	505.233	53.439	507.735	53.446	510.237	53.454	512.739	53.464	515.240	53.474	517.743	53.485	520.245	53.497	522.748	53.510	525.251	53.524	2200	
2000	450.890	48.564	453.391	48.568	455.892	48.573	458.393	48.578	460.895	48.585	463.396	48.594	465.898	48.603	468.401	48.613	470.903	48.624	473.406	48.636	475.908	48.649	478.411	48.664	480.915	48.679	2000	
1800	406.551	43.708	409.052	43.713	411.553	43.718	414.055	43.725	416.556	43.732	419.058	43.741	421.561	43.751	424.063	43.762	426.565	43.775	429.068	43.789	431.572	43.803	434.075	43.820	436.579	43.837	1800	
1500	340.043	36.426	342.544	36.431	345.046	36.437	347.547	36.445	350.049	36.454	352.552	36.465	355.054	36.477	357.557	36.490	360.060	36.505	362.563	36.522	365.067	36.540	367.571	36.559	370.076	36.579	1500	
1200	273.535	29.144	276.037	29.150	278.538	29.158	281.040	29.167	283.543	29.179	286.045	29.193	288.549	29.208	291.052	29.225	293.556	29.243	296.060	29.263	298.565	29.286	301.070	29.310	303.575	29.335	1200	
1000	229.197	24.289	231.698	24.297	234.200	24.306	236.703	24.318	239.206	24.332	241.709	24.348	244.213	24.366	246.717	24.386	249.222	24.409	251.727	24.433	254.232	24.460	256.738	24.489	259.245	24.520	1000	
900	207.027	21.862	209.529	21.871	212.031	21.881	214.534	21.894	217.037	21.910	219.541	21.927	222.045	21.948	224.550	21.970	227.055	21.995	229.561	22.022	232.067	22.052	234.574	22.084	237.081	22.118	900	
800	184.858	19.436	187.360	19.445	189.863	19.457	192.366	19.472	194.869	19.489	197.374	19.509	199.878	19.532	202.384	19.557	204.889	19.585	207.396	19.616	209.903	19.649	212.410	19.685	214.918	19.724	800	
700	162.689	17.010	165.191	17.020	167.694	17.034	170.198	17.051	172.702	17.071	175.207	17.093	177.712	17.119	180.218	17.148	182.725	17.180	185.232	17.215	187.740	17.253	190.248	17.294	192.757	17.339	700	100 (P)*
600	140.520	14.584	143.023	14.596	145.526	14.612	148.030	14.632	150.535	14.655	153.041	14.682	155.547	14.712	158.054	14.746	160.561	14.783	163.070	14.824	165.579	14.868	168.088	14.916	170.598	14.968	600	
500	118.351	12.159	120.855	12.174	123.359	12.193	125.863	12.217	128.369	12.244	130.876	12.276	133.383	12.313	135.891	12.353	138.400	12.398	140.910	12.447	143.421	12.500	145.932	12.558	148.444	12.620	500	
400	96.183	9.736	98.687	9.755	101.192	9.779	103.698	9.808	106.205	9.843	108.713	9.883	111.222	9.928	113.732	9.979	116.243	10.034	118.755	10.096	121.268	10.162	123.782	10.234	126.297	10.312	400	
360	87.316	8.767	89.820	8.788	92.326	8.815	94.832	8.847	97.340	8.886	99.849	8.930	102.359	8.981	104.870	9.037	107.382	9.099	109.895	9.167	112.410	9.241	114.925	9.321	117.441	9.407	360	
350	85.099	8.525	87.603	8.547	90.109	8.574	92.616	8.608	95.124	8.647	97.633	8.693	100.143	8.745	102.655	8.803	105.167	8.867	107.681	8.937	110.195	9.013	112.711	9.095	115.227	9.184	350	
300	74.015	7.316	76.520	7.341	79.027	7.373	81.535	7.412	84.044	7.458	86.555	7.511	89.066	7.572	91.580	7.639	94.094	7.714	96.609	7.796	99.126	7.885	101.643	7.980	104.162	8.083	300	80 (P)*
250	62.932	6.108	65.438	6.138	67.946	6.177	70.455	6.224	72.966	6.279	75.478	6.343	77.992	6.416	80.508	6.497	83.024	6.586	85.542	6.684	88.061	6.791	90.582	6.906	93.103	7.029	250	
230	58.499	5.626	61.005	5.659	63.514	5.700	66.024	5.751	68.536	5.812	71.049	5.881	73.564	5.960	76.080	6.048	78.598	6.145	81.117	6.252	83.638	6.368	86.159	6.493	88.682	6.627	230	
200	51.849	4.904	54.357	4.941	56.866	4.989	59.378	5.048	61.891	5.117	64.406	5.197	66.923	5.288	69.441	5.389	71.961	5.501	74.483	5.624	77.005	5.757	79.529	5.900	82.054	6.055	200	
170	45.200	4.184	47.709	4.228	50.220	4.284	52.733	4.353	55.248	4.435	57.766	4.529	60.285	4.636	62.806	4.755	65.328	4.886	67.852	5.030	70.378	5.187	72.905	5.356	75.432	5.537	170	65 (P)*
155	41.875	3.825	44.385	3.873	46.897	3.935	49.412	4.011	51.928	4.100	54.447	4.204	56.967	4.320	59.490	4.451	62.014	4.595	64.539	4.753	67.066	4.925	69.595	5.110	72.124	5.309	155	
125	35.228	3.112	37.739	3.171	40.254	3.248	42.771	3.342	45.291	3.453	47.813	3.581	50.337	3.726	52.863	3.887	55.391	4.066	57.920	4.262	60.450	4.474	62.982	4.703	65.514	4.949	125	
100	29.689	2.524	32.203	2.599	34.721	2.695	37.241	2.812	39.765	2.950	42.290	3.110	44.818	3.291	47.348	3.493	49.879	3.715	52.411	3.959	54.944	4.224	57.478	4.510	60.011	4.817	100	
90	27.474	2.292	29.989	2.375	32.509	2.481	35.031	2.612	37.556	2.765	40.084	2.943	42.613	3.143	45.144	3.367	47.677	3.615	50.210	3.886	52.743	4.179	55.277	4.496	57.810	4.836	90	50 (P)*
80	25.259	2.062	27.777	2.156	30.298	2.276	32.822	2.422	35.349	2.595	37.878	2.794	40.410	3.020	42.942	3.271	45.475	3.549	48.009	3.853	50.543	4.183	53.075	4.539	55.607	4.920	80	50 (H)**
70	23.045	1.837	25.565	1.943	28.088	2.080	30.614	2.247	33.144	2.445	35.675	2.672	38.208	2.930	40.741	3.217	43.275	3.534	45.808	3.880	48.340	4.256	50.870	4.661	53.397	5.094	70	
60	20.832	1.617	23.354	1.741	25.880	1.901	28.409	2.096	30.940	2.325	33.473	2.590	36.007	2.890	38.540	3.224	41.072	3.592	43.603	3.995	46.130	4.431	48.654	4.900	51.173	5.403	60	40 (P)*
55	19.726	1.510	22.249	1.645	24.776	1.819	27.307	2.032	29.839	2.283	32.373	2.571	34.906	2.897	37.439	3.261	39.969	3.662	42.496	4.099	45.019	4.573	47.537	5.083	50.049	5.628	55	
50	18.621	1.406	21.145	1.555	23.674	1.746	26.206	1.980	28.739	2.255	31.272	2.572	33.805	2.930	36.336	3.329	38.863	3.768	41.385	4.248	43.901	4.766	46.410	5.324	48.911	5.920	50	40 (H)**
45	17.515	1.306	20.042	1.471	22.572	1.684	25.105	1.943	27.639	2.248	30.171	2.599	32.702	2.996	35.229	3.438	37.750	3.924	40.265	4.453	42.771	5.026	45.267	5.641	47.751	6.297	45	35 (P)*
40	16.411	1.211	18.939	1.397	21.471	1.636	24.005	1.927	26.538	2.269	29.068	2.663	31.595	3.108	34.115	3.602	36.627	4.145	39.129	4.736	41.619	5.374	44.094	6.059	46.555	6.788	40	35 (H) 30 (P)*
35	15.307	1.124	17.837	1.336	20.371	1.608	22.904	1.940	25.435	2.330	27.961	2.778	30.480	3.283	32.988	3.843	35.484	4.458	37.965	5.126	40.429	5.846	42.873	6.616	45.294	7.434	35	
33	14.866	1.092	17.397	1.317	19.930	1.605	22.463	1.957	24.993	2.370	27.516	2.844	30.029	3.377	32.531	3.969	35.018	4.618	37.487	5.322	39.936	6.080	42.362	6.890	44.762	7.749	33	
30	14.204	1.048	16.737	1.295	19.270	1.612	21.801	1.997	24.327	2.450	26.843	2.969	29.347	3.552	31.834	4.198	34.302	4.905	36.748	5.671	39.168	6.493	41.559	7.370	43.919	8.299	30	30 (H)*
25	13.103	0.990	15.636	1.286	18.168	1.664	20.692	2.124	23.205	2.662	25.701	3.277	28.175	3.966	30.623	4.726	33.040	5.554	35.422	6.446	37.765	7.400	40.065	8.410	42.318	9.474	25	
23	12.662	0.974	15.196	1.296	17.725	1.706	20.245	2.203	22.749	2.785	25.231	3.448	27.686	4.190	30.109	5.006	32.494	5.893	34.837	6.847	37.133	7.862	39.377	8.935			23	25 (P)*
20	12.002	0.963	14.534	1.337	17.058	1.801	19.564	2.368	22.047	3.029	24.499	3.780	26.911	4.617	29.279	5.532	31.595	6.522	33.855	7.579							20	25 (H)**
15	10.901	0.999	13.422	1.484	15.917	2.099	18.374	2.835	20.780	3.685	23.122	4.638	25.391	5.684													15	20 (P)*
14	10.679	1.019	13.195	1.537	15.680	2.192	18.118	2.974	20.495	3.873	22.800	4.877															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 25 Degrees

$\Delta = 25°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	594.260	60.808	596.762	60.822	599.266	60.837	601.769	60.853	604.272	60.870	606.776	60.887	609.280	60.906	611.784	60.925	614.288	60.945	616.793	60.966	619.297	60.988	621.802	61.010	624.307	61.034	2500	
2200	527.754	53.539	530.258	53.555	532.761	53.572	535.265	53.590	537.769	53.609	540.273	53.629	542.778	53.650	545 282	53.672	547.787	53.694	550.292	53.718	552.797	53.743	555.302	53.769	557.808	53.795	2200	
2000	483.418	48.696	485.922	48.713	488.426	48.732	490.930	48.752	493.434	48.772	495.939	48.794	498.444	48.818	500.949	48.841	503.454	48.866	505.959	48.893	508.465	48.920	510.971	48.948	513.477	48.977	2000	
1800	439.082	43.855	441.586	43.875	444.091	43.895	446.595	43.917	449.100	43.940	451.605	43.965	454.111	43.990	456.616	44.017	459.122	44.045	461.628	44.074	464.134	44.104	466.641	44.135	469.147	44.168	1800	
1500	372.580	36.602	375.085	36.625	377.591	36.650	380.096	36.676	382.601	36.704	385.107	36.733	387.614	36.764	390.120	36.796	392.627	36.829	395.134	36.864	397.642	36.900	400.149	36.938	402.657	36.977	1500	
1200	306.081	29.363	308.587	29.393	311.094	29.424	313.600	29.456	316.107	29.491	318.615	29.528	321.123	29.566	323.631	29.606	326.139	29.648	328.648	29.691	331.157	29.736	333.667	29.784	336.177	29.833	1200	
1000	261.751	24.553	264.259	24.588	266.766	24.625	269.274	24.665	271.783	24.707	274.292	24.750	276.801	24.796	279.310	24.844	281.820	24.894	284.331	24.946	286.842	25.001	289.353	25.057	291.864	25.116	1000	
900	239.588	22.155	242.096	22.194	244.604	22.236	247.113	22.280	249.623	22.326	252.132	22.374	254.642	22.425	257.153	22.479	259.664	22.534	262.175	22.592	264.687	22.653	267.199	22.716	269.712	22.781	900	
800	217.426	19.765	219.935	19.809	222.444	19.856	224.954	19.905	227.465	19.957	229.975	20.012	232.487	20.069	234.998	20.129	237.511	20.192	240.023	20.257	242.536	20.325	245.050	20.396	247.564	20.469	800	
700	195.266	17.386	197.776	17.436	200.287	17.490	202.798	17.546	205.310	17.605	207.822	17.668	210.334	17.733	212.848	17.802	215.361	17.874	217.876	17.948	220.390	18.026	222.906	18.106	225.421	18.190	700	
600	173.109	15.023	175.621	15.082	178.133	15.144	180.646	15.210	183.159	15.279	185.673	15.352	188.188	15.428	190.703	15.508	193.218	15.592	195.735	15.679	198.251	15.769	200.769	15.864	203.287	15.961	600	
500	150.957	12.686	153.470	12.756	155.985	12.831	158.500	12.910	161.015	12.993	163.532	13.081	166.049	13.172	168.566	13.268	171.084	13.368	173.603	13.473	176.123	13.582	178.643	13.695	181.163	13.812	500	
400	128.812	10.395	131.329	10.482	133.846	10.576	136.364	10.674	138.883	10.778	141.402	10.887	143.922	11.002	146.443	11.122	148.965	11.247	151.488	11.377	154.011	11.513	156.534	11.654	159.059	11.801	400	
360	119.958	9.499	122.476	9.597	124.994	9.700	127.514	9.810	130.034	9.925	132.556	10.047	135.077	10.174	137.600	10.307	140.124	10.446	142.648	10.591	145.173	10.742	147.698	10.898	150.224	11.061	360	100 (P)*
350	117.744	9.278	120.263	9.378	122.782	9.485	125.302	9.598	127.823	9.717	130.344	9.841	132.867	9.972	135.390	10.109	137.914	10.252	140.439	10.401	142.964	10.556	145.490	10.717	148.016	10.885	350	
300	106.682	8.194	109.202	8.311	111.724	8.435	114.246	8.567	116.770	8.705	119.294	8.851	121.819	9.003	124.345	9.163	126.871	9.329	129.398	9.503	131.926	9.684	134.455	9.872	136.984	10.067	300	
250	95.626	7.161	98.149	7.302	100.674	7.451	103.200	7.609	105.726	7.775	108.253	7.949	110.781	8.132	113.310	8.323	115.840	8.523	118.370	8.731	120.900	8.948	123.432	9.173	125.963	9.406	250	
230	91.206	6.771	93.731	6.923	96.257	7.085	98.784	7.256	101.312	7.437	103.841	7.626	106.370	7.825	108.900	8.033	111.431	8.250	113.962	8.476	116.494	8.711	119.026	8.956	121.559	9.209	230	80 (P)*
200	84.581	6.220	87.108	6.395	89.637	6.581	92.166	6.778	94.696	6.985	97.227	7.203	99.758	7.431	102.290	7.670	104.822	7.919	107.355	8.179	109.888	8.449	112.422	8.729	114.955	9.020	200	
170	77.961	5.731	80.491	5.937	83.022	6.156	85.554	6.387	88.086	6.630	90.619	6.886	93.152	7.154	95.685	7.434	98.219	7.727	100.752	8.031	103.286	8.348	105.820	8.677	108.353	9.018	170	
155	74.655	5.521	77.186	5.747	79.718	5.987	82.250	6.240	84.783	6.507	87.317	6.787	89.850	7.080	92.384	7.387	94.918	7.707	97.451	8.041	99.984	8.388	102.517	8.748	105.049	9.121	155	65 (P)*
125	68.047	5.212	70.580	5.492	73.114	5.788	75.648	6.100	78.181	6.430	80.714	6.776	83.247	7.138	85.779	7.516	88.309	7.911	90.839	8.322	93.367	8.750	95.894	9.193	98.419	9.652	125	
100	62.545	5.144	65.078	5.492	67.610	5.860	70.141	6.249	72.671	6.658	75.199	7.087	77.725	7.537	80.249	8.006	82.770	8.495	85.288	9.004	87.802	9.533	90.314	10.081	92.821	10.648	100	
90	60.343	5.199	62.874	5.584	65.404	5.992	67.932	6.423	70.458	6.875	72.981	7.350	75.500	7.847	78.017	8.366	80.529	8.906	83.038	9.468	85.541	10.052	88.040	10.656	90.533	11.281	90	50 (P)*
80	58.137	5.326	60.665	5.758	63.190	6.215	65.712	6.697	68.230	7.203	70.744	7.734	73.254	8.290	75.759	8.869	78.258	9.472	80.751	10.099	83.237	10.749	85.717	11.422	88.189	12.117	80	50 (H)**
70	55.922	5.556	58.443	6.047	60.959	6.566	63.470	7.112	65.976	7.687	68.475	8.288	70.968	8.916	73.453	9.571	75.930	10.252	78.398	10.959	80.857	11.692	83.306	12.449	85.745	13.232	70	
60	53.686	5.938	56.193	6.505	58.693	7.104	61.185	7.735	63.668	8.396	66.142	9.088	68.605	9.810	71.056	10.561	73.496	11.341	75.922	12.150	78.336	12.986	80.734	13.850	83.118	14.740	60	40 (P)*
55	52.553	6.209	55.049	6.824	57.536	7.473	60.012	8.155	62.478	8.870	64.931	9.617	67.371	10.396	69.797	11.206	72.208	12.046	74.604	12.916	76.983	13.814	79.344	14.741	81.687	15.694	55	
50	51.402	6.554	53.882	7.224	56.351	7.931	58.806	8.674	61.246	9.451	63.672	10.263	66.081	11.107	68.472	11.984	70.845	12.892	73.198	13.831	75.531	14.799	77.842	15.796	80.130	16.820	50	40 (H)**
45	50.223	6.994	52.680	7.731	55.122	8.506	57.546	9.319	59.952	10.169	62.339	11.055	64.704	11.975	67.047	12.929	69.366	13.914	71.661	14.931	73.930	15.978	76.173	17.053	78.387	18.155	45	35 (P)*
40	48.997	7.561	51.421	8.376	53.823	9.233	56.203	10.130	58.558	11.065	60.888	12.037	63.191	13.044	65.465	14.085	67.709	15.158	69.922	16.262							40	30 (H)**
35	47.692	8.300	50.063	9.210	52.406	10.164	54.719	11.158	56.999	12.192	59.246	13.263															35	
33	47.135	8.657	49.478	9.611	51.789	10.608	54.065	11.646	56.305	12.724																	33	30 (P)*
30	46.244	9.276	48.533	10.301	50.782	11.368																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 26 Degrees

$\Delta = 26°$

R_C	$L_S = 15$ metres		$L_S = 20$ metres		$L_S = 25$ metres		$L_S = 30$ metres		$L_S = 35$ metres		$L_S = 40$ metres		$L_S = 45$ metres		$L_S = 50$ metres		$L_S = 55$ metres		$L_S = 60$ metres		$L_S = 65$ metres		$L_S = 70$ metres		$L_S = 75$ metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre			
2500	584.671	65.764	587.172	65.767	589.673	65.771	592.174	65.776	594.675	65.782	597.176	65.788	599.678	65.795	602.180	65.803	604.682	65.813	607.184	65.822	609.686	65.833	612.189	65.844	614.691	65.857	2500	
2200	515.411	57.874	517.911	57.877	520.412	57.881	522.914	57.887	525.415	57.893	527.917	57.900	530.418	57.909	532.921	57.918	535.423	57.928	537.925	57.939	540.428	57.951	542.931	57.965	545.434	57.979	2200	
2000	469.237	52.613	471.738	52.617	474.239	52.622	476.740	52.628	479.242	52.635	481.744	52.643	484.246	52.652	486.748	52.662	489.250	52.673	491.753	52.685	494.256	52.699	496.759	52.713	499.263	52.729	2000	
1800	423.064	47.353	425.565	47.357	428.066	47.362	430.567	47.369	433.069	47.377	435.571	47.386	438.073	47.396	440.576	47.407	443.078	47.419	445.582	47.433	448.085	47.448	450.588	47.464	453.092	47.481	1800	
1500	353.803	39.463	356.305	39.468	358.806	39.474	361.308	39.482	363.810	39.491	366.312	39.502	368.815	39.514	371.318	39.528	373.821	39.542	376.325	39.559	378.829	39.577	381.333	39.596	383.837	39.617	1500	
1200	284.543	31.573	287.045	31.579	289.547	31.587	292.049	31.597	294.552	31.609	297.054	31.622	299.558	31.637	302.062	31.654	304.565	31.673	307.070	31.693	309.575	31.716	312.080	31.740	314.585	31.766	1200	
1000	238.370	26.314	240.872	26.321	243.374	26.331	245.877	26.343	248.380	26.357	250.883	26.373	253.387	26.391	255.892	26.411	258.396	26.434	260.902	26.458	263.407	26.485	265.914	26.514	268.420	26.545	1000	
900	215.284	23.685	217.785	23.693	220.288	23.704	222.791	23.717	225.294	23.732	227.798	23.750	230.302	23.770	232.807	23.792	235.313	23.818	237.819	23.845	240.325	23.875	242.832	23.906	245.339	23.941	900	
800	192.197	21.055	194.699	21.065	197.202	21.077	199.705	21.092	202.209	21.109	204.713	21.129	207.218	21.152	209.724	21.177	212.230	21.205	214.736	21.236	217.243	21.269	219.751	21.305	222.259	21.344	800	
700	169.111	18.427	171.613	18.438	174.116	18.451	176.620	18.468	179.124	18.488	181.629	18.511	184.135	18.537	186.641	18.566	189.148	18.598	191.655	18.633	194.163	18.671	196.672	18.712	199.181	18.757	700	100 (P)*
600	146.024	15.799	148.527	15.811	151.031	15.827	153.535	15.847	156.040	15.870	158.546	15.896	161.052	15.927	163.559	15.961	166.067	15.998	168.576	16.039	171.085	16.084	173.593	16.132	176.106	16.183	600	
500	122.938	13.171	125.442	13.187	127.946	13.206	130.451	13.229	132.957	13.257	135.464	13.289	137.971	13.325	140.480	13.366	142.989	13.411	145.500	13.460	148.011	13.513	150.523	13.571	153.035	13.633	500	
400	99.853	10.546	102.357	10.564	104.862	10.589	107.368	10.618	109.876	10.653	112.384	10.693	114.894	10.738	117.404	10.789	119.916	10.845	122.428	10.906	124.942	10.973	127.456	11.045	129.971	11.123	400	
360	90.618	9.496	93.123	9.517	95.629	9.544	98.136	9.576	100.644	9.615	103.153	9.659	105.664	9.710	108.175	9.766	110.688	9.829	113.202	9.897	115.717	9.971	118.232	10.051	120.749	10.137	360	
350	88.310	9.234	90.815	9.255	93.320	9.283	95.828	9.316	98.336	9.356	100.846	9.402	103.356	9.454	105.868	9.512	108.381	9.576	110.895	9.646	113.411	9.723	115.927	9.805	118.444	9.894	350	
300	76.767	7.923	79.273	7.948	81.780	7.980	84.288	8.020	86.798	8.066	89.309	8.119	91.821	8.180	94.335	8.248	96.850	8.322	99.366	8.404	101.883	8.493	104.402	8.589	106.921	8.693	300	80 (P)*
250	65.225	6.615	67.732	6.645	70.240	6.683	72.750	6.730	75.261	6.786	77.774	6.850	80.289	6.922	82.805	7.003	85.322	7.093	87.841	7.191	90.361	7.298	92.883	7.414	95.405	7.537	250	
230	60.609	6.092	63.116	6.124	65.625	6.166	68.135	6.217	70.648	6.278	73.162	6.347	75.677	6.426	78.194	6.515	80.713	6.612	83.233	6.719	85.755	6.835	88.277	6.960	90.801	7.095	230	
200	53.684	5.309	56.192	5.346	58.702	5.394	61.214	5.453	63.728	5.523	66.244	5.603	68.761	5.694	71.281	5.795	73.802	5.907	76.324	6.030	78.848	6.163	81.373	6.307	83.900	6.462	200	
170	46.760	4.528	49.269	4.572	51.781	4.629	54.295	4.698	56.811	4.780	59.329	4.874	61.849	4.981	64.371	5.100	66.895	5.232	69.420	5.376	71.947	5.533	74.475	5.702	77.005	5.884	170	65 (P)*
155	43.298	4.139	45.808	4.187	48.321	4.250	50.836	4.325	53.353	4.415	55.873	4.518	58.394	4.635	60.918	4.766	63.443	4.911	65.970	5.069	68.499	5.241	71.029	5.427	73.560	5.626	155	
125	36.375	3.365	38.887	3.425	41.402	3.502	43.921	3.595	46.441	3.707	48.964	3.835	51.490	3.980	54.017	4.142	56.547	4.321	59.077	4.517	61.610	4.730	64.143	4.960	66.678	5.206	125	
100	30.607	2.727	33.122	2.801	35.640	2.898	38.162	3.015	40.687	3.154	43.214	3.314	45.743	3.495	48.275	3.697	50.808	3.921	53.342	4.165	55.878	4.430	58.414	4.717	60.950	5.024	100	
90	28.300	2.474	30.817	2.557	33.337	2.664	35.860	2.795	38.387	2.949	40.916	3.126	43.447	3.327	45.980	3.552	48.515	3.800	51.051	4.071	53.587	4.366	56.123	4.683	58.660	5.024	90	50 (P)*
80	25.994	2.225	28.512	2.318	31.034	2.438	33.560	2.585	36.089	2.758	38.620	2.958	41.153	3.184	43.688	3.436	46.224	3.715	48.760	4.019	51.297	4.349	53.833	4.706	56.368	5.088	80	50 (H)**
70	23.689	1.979	26.209	2.085	28.733	2.223	31.261	2.390	33.792	2.588	36.326	2.816	38.861	3.074	41.397	3.362	43.933	3.679	46.470	4.026	49.005	4.403	51.538	4.808	54.070	5.243	70	
60	21.384	1.739	23.907	1.863	26.434	2.023	28.965	2.218	31.498	2.449	34.034	2.714	36.570	3.014	39.106	3.349	41.642	3.718	44.176	4.121	46.707	4.558	49.235	5.028	51.758	5.532	60	40 (P)*
55	20.232	1.622	22.757	1.757	25.285	1.932	27.818	2.145	30.352	2.396	32.888	2.685	35.425	3.012	37.961	3.376	40.495	3.778	43.026	4.216	45.553	4.691	48.075	5.202	50.592	5.748	55	
50	19.081	1.507	21.607	1.657	24.137	1.849	26.671	2.082	29.207	2.358	31.743	2.676	34.279	3.035	36.813	3.434	39.344	3.875	41.871	4.355	44.392	4.875	46.906	5.433	49.412	6.031	50	40 (H)**
45	17.930	1.397	20.458	1.563	22.990	1.776	25.525	2.036	28.062	2.342	30.598	2.693	33.132	3.091	35.663	3.533	38.188	4.020	40.708	4.551	43.219	4.125	45.720	5.741	48.211	6.398	45	35 (P)*
40	16.780	1.292	19.310	1.479	21.844	1.718	24.380	2.010	26.916	2.353	29.451	2.747	31.981	3.193	34.506	3.694	37.022	4.232	39.529	4.824	42.025	5.464	44.507	6.150	46.974	6.880	40	35 (H) 30 (P)*
35	15.631	1.195	18.163	1.408	20.698	1.681	23.235	2.013	25.769	2.404	28.299	2.853	30.822	3.359	33.336	3.920	35.837	4.536	38.324	5.205	40.794	5.927	43.245	6.698	45.674	7.518	35	
33	15.171	1.159	17.704	1.385	20.240	1.674	22.776	2.026	25.309	2.440	27.837	2.914	30.355	3.449	32.862	4.042	35.354	4.692	37.830	5.398	40.286	6.157	42.719	6.969	45.127	7.830	33	
30	14.482	1.109	17.017	1.357	19.553	1.674	22.088	2.061	24.617	2.514	27.138	3.034	29.647	3.618	32.140	4.266	34.615	4.974	37.067	5.741	39.495	6.565	41.894	7.444	44.262	8.374	30	30 (H)**
25	13.336	1.041	15.872	1.338	18.407	1.717	20.935	2.177	23.453	2.717	25.954	3.333	28.435	4.023	30.889	4.784	33.314	5.614	35.704	6.508	38.055	7.464	40.364	8.476	42.627	9.542	25	
23	12.877	1.022	15.413	1.344	17.947	1.755	20.471	2.233	22.980	2.836	25.468	3.501	27.930	4.244	30.360	5.062	32.753	5.951	35.104	6.906	37.409	7.923	39.663	8.998			23	25 (P)*
20	12.190	1.005	14.725	1.374	17.253	1.844	19.765	2.412	22.253	3.075	24.712	3.827	27.132	4.665	29.508	5.583	31.833	6.574	34.102	7.633							20	25 (H)**
15	11.044	1.030	13.569	1.517	16.070	2.133	18.534	2.871	20.947	3.722	23.298	4.677	25.576	5.725													15	20 (P)*
14	10.814	1.049	13.334	1.568	15.825	2.224	18.270	3.007	20.656	3.908	22.969	4.914															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 26 Degrees

$\Delta = 26°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	617.195	65.870	619.692	65.884	622.201	65.899	624.704	65.915	627.208	65.932	629.712	65.949	632.216	65.968	634.720	65.987	637.224	66.007	639.729	66.028	642.234	66.050	644.739	66.072	647.244	66.096	2500	
2200	547.937	57.994	550.441	58.010	552.944	58.027	555.448	58.045	557.953	58.064	560.457	58.083	562.961	58.105	565.466	58.126	567.971	58.149	570.476	58.173	572.982	58.198	575.487	58.224	577.993	58.250	2200	
2000	501.766	52.745	504.270	52.763	506.774	52.782	509.279	52.802	511.783	52.822	514.288	52.844	516.793	52.867	519.298	52.891	521.804	52.917	524.309	52.942	526.815	52.970	529.321	52.998	531.827	53.027	2000	
1800	455.596	47.500	458.100	47.519	460.605	47.540	463.110	47.562	465.615	47.585	468.120	47.609	470.625	47.635	473.131	47.662	475.637	47.690	478.144	47.719	480.650	47.749	483.157	47.781	485.664	47.813	1800	
1500	386.342	39.639	388.847	39.662	391.353	39.688	393.858	39.714	396.364	39.741	398.871	39.771	401.377	39.802	403.884	39.833	406.391	39.867	408.899	39.902	411.406	39.938	413.914	39.976	416.423	40.015	1500	
1200	317.092	31.793	319.598	31.823	322.104	31.854	324.612	31.886	327.119	31.921	329.627	31.958	332.135	31.996	334.643	32.036	337.152	32.078	339.661	32.122	342.171	32.167	344.681	32.215	347.191	32.263	1200	
1000	270.927	26.578	273.435	26.613	275.943	26.651	278.451	26.690	280.960	26.732	283.469	26.776	285.979	26.822	288.489	26.870	290.999	26.920	293.510	26.972	296.021	27.027	298.533	27.083	301.045	27.142	1000	
900	247.847	23.978	250.355	24.017	252.864	24.059	255.373	24.103	257.883	24.149	260.393	24.198	262.904	24.249	265.415	24.302	267.926	24.358	270.438	24.416	272.950	24.477	275.463	24.540	277.977	24.605	900	
800	224.768	21.385	227.277	21.429	229.787	21.476	232.297	21.526	234.808	21.578	237.319	21.633	239.831	21.690	242.344	21.750	244.856	21.813	247.370	21.878	249.883	21.947	252.398	22.017	254.912	22.091	800	
700	201.691	18.804	204.202	18.854	206.713	18.908	209.224	18.964	211.737	19.024	214.249	19.086	216.763	19.152	219.276	19.221	221.791	19.292	224.306	19.367	226.821	19.445	229.337	19.526	231.854	19.610	700	
600	178.617	16.239	181.130	16.297	183.642	16.360	186.156	16.426	188.670	16.495	191.184	16.568	193.699	16.645	196.215	16.725	198.732	16.809	201.249	16.896	203.766	16.987	206.284	17.081	208.803	17.179	600	
500	155.549	13.699	158.063	13.770	160.578	13.845	163.093	13.924	165.610	14.007	168.127	14.095	170.645	14.187	173.163	14.283	175.682	14.383	178.202	14.488	180.722	14.597	183.243	14.710	185.765	14.827	500	
400	132.488	11.206	135.005	11.294	137.523	11.387	140.042	11.486	142.562	11.590	145.082	11.700	147.603	11.814	150.125	11.935	152.648	12.060	155.172	12.191	157.696	12.327	160.221	12.468	162.747	12.615	400	
360	123.267	10.229	125.786	10.327	128.305	10.431	130.826	10.541	133.347	10.656	135.870	10.778	138.393	10.906	140.917	11.039	143.441	11.178	145.967	11.323	148.493	11.475	151.020	11.632	153.547	11.794	360	100 (P)*
350	120.962	9.988	123.481	10.089	126.002	10.196	128.523	10.308	131.044	10.427	133.567	10.552	136.091	10.684	138.615	10.821	141.140	10.964	143.666	11.113	146.193	11.269	148.720	11.430	151.249	11.598	350	
300	109.442	8.803	111.963	8.920	114.486	9.045	117.010	9.177	119.534	9.315	122.060	9.461	124.586	9.614	127.114	9.774	129.642	9.941	132.170	10.115	134.700	10.296	137.230	10.484	139.761	10.680	300	
250	97.929	7.670	100.454	7.811	102.980	7.960	105.507	8.118	108.035	8.284	110.563	8.459	113.093	8.642	115.624	8.834	118.155	9.034	120.687	9.243	123.220	9.460	125.753	9.685	128.287	9.919	250	
230	93.327	7.239	95.853	7.392	98.381	7.554	100.909	7.725	103.439	7.906	105.969	8.096	108.500	8.295	111.032	8.503	113.565	8.721	116.098	8.947	118.632	9.183	121.166	9.428	123.701	9.682	230	80 (P)*
200	86.428	6.627	88.957	6.803	91.487	6.990	94.018	7.187	96.550	7.394	99.082	7.612	101.616	7.841	104.150	8.080	106.684	8.330	109.220	8.590	111.755	8.861	114.291	9.142	116.827	9.433	200	
170	79.535	6.078	82.067	6.285	84.600	6.504	87.133	6.736	89.668	6.979	92.203	7.236	94.738	7.504	97.274	7.785	99.811	8.078	102.347	8.383	104.883	8.701	107.420	9.030	109.956	9.372	170	
155	76.092	5.839	78.625	6.065	81.160	6.305	83.694	6.559	86.230	6.826	88.766	7.106	91.302	7.400	93.839	7.708	96.375	8.029	98.911	8.363	101.448	8.710	103.984	9.071	106.519	9.445	155	65 (P)*
125	69.213	5.469	71.749	5.750	74.285	6.046	76.822	6.360	79.358	6.690	81.894	7.036	84.430	7.399	86.965	7.778	89.500	8.174	92.033	8.586	94.565	9.014	97.096	9.458	99.625	9.919	125	
100	63.487	5.352	66.023	5.700	68.558	6.069	71.093	6.459	73.626	6.869	76.158	7.299	78.688	7.749	81.216	8.219	83.742	8.710	86.264	9.220	88.783	9.749	91.299	10.298	93.812	10.867	100	
90	61.195	5.387	63.730	5.773	66.264	6.182	68.796	6.613	71.325	7.067	73.852	7.543	76.377	8.041	78.898	8.560	81.415	9.102	83.928	9.665	86.437	10.249	88.941	10.855	91.440	11.482	90	50 (P)*
80	58.901	5.495	61.433	5.928	63.962	6.385	66.488	6.868	69.011	7.376	71.530	7.908	74.045	8.464	76.555	9.045	79.059	9.649	81.558	10.277	84.050	10.928	86.536	11.602	89.014	12.299	80	50 (H)**
70	56.599	5.706	59.124	6.197	61.645	6.717	64.161	7.265	66.672	7.840	69.177	8.443	71.675	9.072	74.166	9.728	76.649	10.411	79.123	11.119	81.589	11.853	84.045	12.612	86.490	13.396	70	
60	54.277	6.068	56.789	6.636	59.294	7.237	61.792	7.868	64.281	8.531	66.760	9.225	69.230	9.948	71.688	10.701	74.135	11.482	76.569	12.293	78.989	13.131	81.396	13.996	83.787	14.888	60	40 (P)*
55	53.101	6.330	55.603	6.946	58.095	7.596	60.578	8.280	63.050	8.996	65.510	9.745	67.957	10.526	70.390	11.337	72.809	12.179	75.212	13.050	77.599	13.950	79.969	14.878	82.320	15.834	55	
50	51.909	6.665	54.395	7.337	56.869	8.046	59.331	8.790	61.779	9.569	64.212	10.382	66.628	11.228	69.027	12.106	71.408	13.016	73.770	13.957	76.111	14.927	78.431	15.926	80.729	16.952	50	40 (H)**
45	50.689	7.097	53.152	7.835	55.601	8.612	58.033	9.427	60.446	10.278	62.841	11.166	65.214	12.088	67.566	13.043	69.894	14.031	72.198	15.050	74.477	16.098	76.729	17.175	78.953	18.280	45	35 (P)*
40	49.423	7.655	51.854	8.472	54.264	9.331	56.652	10.229	59.016	11.166	61.354	12.139	63.666	13.149	65.949	14.192	68.203	15.267	70.426	16.373							40	30 (H)**
35	48.080	8.385	50.459	9.297	52.811	10.253	55.132	11.250	57.422	12.286	59.678	13.359															35	
33	47.508	8.740	49.860	9.695	52.179	10.694	54.465	11.735	56.715	12.814																	33	30 (P)*
30	46.596	9.354	48.894	10.380	51.152	11.450																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 27 Degrees

$\Delta = 27°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	607.698	71.041	610.198	71.044	612.699	71.048	615.200	71.052	617.701	71.058	620.203	71.064	622.705	71.072	625.207	71.080	627.709	71.089	630.211	71.099	632.713	71.109	635.216	71.121	637.719	71.133	2500	
2200	535.674	62.517	538.175	62.520	540.676	62.524	543.177	62.530	545.678	62.536	548.180	62.543	550.682	62.552	553.184	62.561	555.687	62.571	558.189	62.583	560.692	62.595	563.195	62.608	565.698	62.622	2200	
2000	487.658	56.834	490.159	56.838	492.660	56.843	495.162	56.849	497.663	56.856	500.165	56.864	502.667	56.873	505.170	56.883	507.672	56.894	510.175	56.906	512.678	56.920	515.181	56.934	517.685	56.950	2000	
1800	439.643	51.152	442.144	51.156	444.645	51.161	447.146	51.168	449.648	51.176	452.150	51.185	454.653	51.195	457.155	51.206	459.658	51.219	462.161	51.232	464.665	51.247	467.168	51.263	469.672	51.280	1800	
1500	367.619	42.629	370.121	42.634	372.622	42.640	375.124	42.648	377.626	42.657	380.129	42.668	382.631	42.680	385.134	42.693	387.638	42.708	390.142	42.725	392.646	42.743	395.150	42.762	397.655	42.783	1500	
1200	295.596	34.106	298.098	34.112	300.600	34.120	303.102	34.130	305.604	34.141	308.107	34.155	310.611	34.170	313.115	34.187	315.619	34.206	318.124	34.226	320.629	34.249	323.134	34.273	325.640	34.299	1200	
1000	247.581	28.424	250.083	28.432	252.585	28.442	255.088	28.453	257.591	28.467	260.094	28.483	262.599	28.502	265.103	28.522	267.608	28.544	270.114	28.569	272.620	28.596	275.126	28.625	277.633	28.656	1000	
900	223.573	25.584	226.075	25.592	228.578	25.603	231.081	25.616	233.584	25.632	236.088	25.649	238.593	25.670	241.098	25.692	243.604	25.717	246.110	25.745	248.616	25.774	251.123	25.806	253.631	25.841	900	
800	199.566	22.744	202.068	22.753	204.571	22.765	207.074	22.780	209.578	22.797	212.082	22.817	214.588	22.840	217.093	22.866	219.600	22.894	222.107	22.925	224.614	22.958	227.122	22.994	229.630	23.033	800	
700	175.558	19.904	178.061	19.915	180.564	19.928	183.068	19.945	185.572	19.965	188.077	19.988	190.583	20.014	193.090	20.043	195.597	20.075	198.105	20.111	200.613	20.149	203.122	20.190	205.632	20.235	700	100 (P)*
600	151.551	17.065	154.054	17.077	156.557	17.094	159.062	17.113	161.567	17.136	164.073	17.163	166.580	17.193	169.087	17.227	171.596	17.265	174.105	17.306	176.614	17.351	179.125	17.399	181.636	17.450	600	
500	127.544	14.227	130.047	14.232	132.552	14.261	135.057	14.284	137.563	14.312	140.070	14.344	142.578	14.381	145.087	14.422	147.597	14.467	150.108	14.516	152.619	14.569	155.132	14.627	157.645	14.689	500	
400	103.537	11.390	106.041	11.409	108.547	11.433	111.053	11.462	113.561	11.497	116.070	11.537	118.580	11.583	121.091	11.634	123.603	11.690	126.116	11.751	128.630	11.818	131.145	11.891	133.661	11.968	400	
360	93.934	10.256	96.439	10.277	98.945	10.304	101.452	10.336	103.961	10.375	106.471	10.420	108.982	10.470	111.494	10.527	114.007	10.589	116.521	10.658	119.037	10.732	121.553	10.812	124.071	10.899	360	
350	91.534	9.973	94.039	9.994	96.545	10.022	99.052	10.055	103.561	10.095	104.071	10.141	106.582	10.193	109.095	10.251	111.608	10.315	114.123	10.386	116.639	10.462	119.156	10.545	121.674	10.634	350	
300	79.531	8.557	82.037	8.582	84.544	8.614	87.052	8.653	89.562	8.699	92.074	8.753	94.587	8.814	97.101	8.881	99.617	8.956	102.134	9.038	104.652	9.128	107.171	9.224	109.692	9.327	300	80 (P)*
250	67.528	7.142	70.035	7.172	72.544	7.211	75.054	7.258	77.566	7.314	80.079	7.378	82.595	7.451	85.111	7.532	87.630	7.622	90.149	7.720	92.670	7.827	95.193	7.943	97.716	8.067	250	
230	62.728	6.577	65.235	6.610	67.744	6.652	70.255	6.703	72.768	6.764	75.283	6.833	77.799	6.913	80.317	7.001	82.836	7.099	85.358	7.206	87.880	7.322	90.404	7.448	92.929	7.582	230	
200	55.527	5.731	58.035	5.769	60.545	5.817	63.058	5.876	65.573	5.945	68.089	6.026	70.607	6.117	73.128	6.218	75.650	6.331	78.173	6.454	80.698	6.587	83.225	6.732	85.753	6.887	200	
170	48.326	4.887	50.836	4.931	53.348	4.988	55.862	5.057	58.379	5.139	60.898	5.234	63.419	5.341	65.942	5.460	68.467	5.592	70.994	5.737	73.522	5.894	76.052	6.064	78.583	6.246	170	65 (P)*
155	44.726	4.466	47.237	4.515	49.750	4.577	52.266	4.653	54.784	4.743	57.304	4.846	59.827	4.964	62.352	5.095	64.878	5.240	67.407	5.398	69.937	5.570	72.468	5.756	75.001	5.956	155	
125	37.527	3.629	40.040	3.689	42.556	3.766	45.075	3.860	47.596	3.971	50.121	4.100	52.647	4.245	55.176	4.408	57.707	4.587	60.240	4.783	62.774	4.997	65.310	5.227	67.846	5.474	125	
100	31.529	2.938	34.045	3.013	36.564	3.109	39.087	3.227	41.612	3.366	44.141	3.526	46.672	3.708	49.205	3.910	51.740	4.134	54.277	4.379	56.815	4.645	59.353	4.932	61.893	5.240	100	
90	29.130	2.664	31.647	2.748	34.168	2.855	36.693	2.985	39.221	3.140	41.752	3.318	44.285	3.519	46.820	3.744	49.357	3.993	51.895	4.265	54.434	4.560	56.973	4.878	59.512	5.219	90	50 (P)*
80	26.732	2.394	29.251	2.487	31.774	2.608	34.301	2.755	36.831	2.928	39.364	3.128	41.900	3.355	44.437	3.608	46.975	3.887	49.514	4.192	52.054	4.523	54.593	4.880	57.131	5.263	80	50 (H)**
70	24.335	2.127	26.856	2.234	29.381	2.371	31.911	2.539	34.444	2.737	36.979	2.966	39.517	3.224	42.055	3.512	44.595	3.831	47.134	4.178	49.673	4.556	52.210	4.962	54.745	5.397	70	
60	21.928	1.865	24.462	1.990	26.991	2.151	29.523	2.346	32.059	2.577	34.597	2.843	37.136	3.144	39.675	3.479	42.214	3.849	44.751	4.253	47.286	4.691	49.819	5.162	52.347	5.667	60	40 (P)*
55	20.741	1.738	23.266	1.874	25.796	2.049	28.330	2.262	30.867	2.514	33.406	2.804	35.945	3.131	38.484	3.496	41.022	3.899	43.557	4.338	46.089	4.814	48.616	5.326	51.137	5.873	55	
50	19.543	1.611	22.071	1.763	24.603	1.955	27.139	2.190	29.677	2.466	32.216	2.784	34.755	3.144	37.293	3.544	39.828	3.985	42.359	4.467	44.884	4.987	47.403	5.547	49.915	6.146	50	40 (H)**
45	18.347	1.493	20.876	1.659	23.410	1.872	25.947	2.132	28.487	2.439	31.026	2.792	33.565	3.190	36.098	3.633	38.628	4.121	41.152	4.653	43.668	5.228	46.176	5.845	48.672	6.504	45	35 (P)*
40	17.151	1.377	19.682	1.564	22.218	1.804	24.757	2.096	27.296	2.440	29.834	2.835	32.369	3.282	34.898	3.778	37.419	4.323	39.932	4.917	42.433	5.557	44.921	6.245	47.394	6.977	40	35 (H) 30 (P)*
35	15.955	1.270	18.490	1.483	21.028	1.756	23.567	2.089	26.105	2.481	28.639	2.931	31.167	3.437	33.685	4.000	36.192	4.617	38.685	5.288	41.162	6.011	43.619	6.784	46.056	7.606	35	
33	15.478	1.229	18.013	1.455	20.552	1.745	23.091	2.098	25.627	2.512	28.159	2.988	30.682	3.524	33.194	4.118	35.693	4.770	38.174	5.477	40.637	6.238	43.078	7.051	45.494	7.914	33	
30	14.762	1.171	17.298	1.422	19.837	1.740	22.376	2.127	24.909	2.581	27.435	3.102	29.949	3.687	32.448	4.336	34.929	5.046	37.388	5.815	39.823	6.640	42.230	7.521	44.606	8.453	30	30 (H)**
25	13.569	1.093	16.108	1.392	18.646	1.772	21.179	2.233	23.702	2.774	26.209	3.391	28.695	4.083	31.157	4.846	33.589	5.677	35.987	6.573	38.347	7.530	40.665	8.545	42.937	9.613	25	
23	13.093	1.071	15.632	1.394	18.169	1.806	20.697	2.305	23.211	2.889	25.706	3.555	28.174	4.300	30.611	5.120	33.013	6.010	35.373	6.967	37.687	7.987	39.951	9.064			23	25 (P)*
20	12.379	1.049	14.917	1.418	17.449	1.895	19.966	2.458	22.461	3.122	24.925	3.876	27.353	4.716	29.737	5.635	32.072	6.629	34.350	7.690							20	25 (H)**
15	11.188	1.063	13.717	1.551	16.224	2.168	18.694	2.907	21.115	3.760	23.475	4.717	25.762	5.768													15	20 (P)*
14	10.949	1.079	13.474	1.600	15.970	2.257	18.422	3.042	20.816	3.945	23.139	4.953															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 27 Degrees

$\Delta = 27°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	640.222	71.146	642.725	71.161	645.229	71.176	647.732	71.191	650.236	71.208	652.740	71.226	655.244	71.244	657.749	71.263	660.253	71.284	662.758	71.305	665.263	71.327	667.768	71.349	670.273	71.373	2500	
2200	568.202	62.637	570.705	62.653	573.209	62.670	575.713	62.688	578.218	62.707	580.722	62.727	583.227	62.748	585.732	62.770	588.237	62.793	590.742	62.817	593.248	62.842	595.754	62.867	598.260	62.894	2200	
2000	520.189	56.967	522.693	56.984	525.197	57.003	527.701	57.023	530.206	57.044	532.711	57.066	535.216	57.089	537.722	57.113	540.228	57 138	542.733	57.164	545.240	57.191	547.746	57.220	550.252	57.249	2000	
1800	472.176	51.299	474.681	51.319	477.186	51.339	479.691	51.361	482.196	51.385	484.701	51.409	487.207	51.435	489.713	51.461	492.219	51.489	494.726	51.518	497.232	51.549	499.740	51.580	502.247	51.613	1800	
1500	400.160	42.805	402.665	42.828	405.171	42.854	407.677	42.880	410.183	42.908	412.689	42.937	415.196	42.968	417.703	43.000	420.211	43.033	422.719	43.069	425.227	43.105	427.735	43.143	430.243	43.182	1500	
1200	328.146	34.326	330.653	34.356	333.160	34.387	335.667	34.420	338.175	34.455	340.683	34.491	343.191	34.530	345.700	34.570	348.209	34.612	350.719	34.656	353.229	34.701	355.739	34.749	358.250	34.797	1200	
1000	280.141	28.689	282.648	28.724	285.156	28.762	287.665	28.801	290.175	28.843	292.684	28.887	295.194	28.933	297.705	28.981	300.215	29.032	302.727	29.084	305.239	29.139	307.751	29.196	310.263	29.254	1000	
900	256.139	25.878	258.648	25.917	261.157	25.959	263.667	26.003	266.177	26.049	268.687	26.098	271.198	26.149	273.710	26.203	276.222	26.259	278.734	26.317	281.247	26.378	283.760	26.441	286.274	26.506	900	
800	232.140	23.074	234.649	23.119	237.159	23.166	239.670	23.215	242.181	23.267	244.693	23.322	247.206	23.380	249.718	23.440	252.232	23.503	254.746	23.569	257.260	23.637	259.775	23.708	262.290	23.781	800	
700	208.142	20.282	210.653	20.333	213.165	20.386	215.677	20.443	218.189	20.502	220.703	20.565	223.217	20.631	225.731	20.700	228.246	20.771	230.762	20.846	233.278	20.925	235.794	21.006	238.312	21.090	700	
600	184.148	17.506	186.661	17.565	189.174	17.627	191.688	17.693	194.202	17.763	196.718	17.836	199.233	17.913	201.750	17.993	204.267	18.077	206.785	18.164	209.303	18.255	211.822	18.350	214.342	18.448	600	
500	160.159	14.756	162.674	14.826	165.189	14.901	167.706	14.981	170.223	15.064	172.741	15.152	175.259	15.244	177.778	15.340	180.298	15.441	182.819	15.546	185.341	15.655	187.863	15.768	190.385	15.886	500	
400	136.178	12.051	138.696	12.139	141.215	12.233	143.735	12.332	146.255	12.437	148.777	12.546	151.299	12.661	153.822	12.782	156.346	12.907	158.871	13.038	161.397	13.175	163.923	13.316	166.450	13.463	400	
360	126.590	10.991	129.109	11.089	131.630	11.193	134.151	11.303	136.674	11.419	139.197	11.541	141.722	11.668	144.247	11.802	146.773	11.942	149.299	12.087	151.827	12.239	154.355	12.396	156.884	12.559	360	100 (P)*
350	124.193	10.728	126.713	10.829	129.234	10.936	131.756	11.049	134.279	11.169	136.803	11.294	139.328	11.425	141.853	11.563	144.380	11.706	146.907	11.856	149.435	12.012	151.964	12.174	154.494	12.342	350	
300	112.213	9.438	114.736	9.556	117.260	9.680	119.785	9.812	122.310	9.951	124.837	10.097	127.365	10.250	129.894	10.411	132.423	10.578	134.953	10.753	137.485	10.934	140.016	11.123	142.549	11.319	300	
250	100.241	8.200	102.768	8.341	105.295	8.490	107.823	8.649	110.353	8.815	112.883	8.990	115.414	9.174	117.947	9.366	120.480	9.567	123.013	9.776	125.548	9.993	128.083	10.219	130.619	10.454	250	
230	95.456	7.726	97.984	7.880	100.513	8.042	103.043	8.214	105.574	8.395	108.106	8.586	110.639	8.785	113.172	8.994	115.707	9.212	118.242	9.439	120.778	9.675	123.315	9.920	125.852	10.175	230	80 (P)*
200	88.282	7.052	90.813	7.228	93.344	7.415	95.877	7.613	98.411	7.821	100.945	8.039	103.481	8.268	106.017	8.508	108.554	8.758	111.092	9.019	113.630	9.290	116.168	9.572	118.707	9.864	200	
170	81.116	6.441	83.649	6.648	86.184	6.867	88.720	7.099	91.256	7.343	93.793	7.600	96.331	7.869	98.870	8.150	101.409	8.444	103.948	8.750	106.487	9.068	109.027	9.399	111.566	9.741	170	
155	77.536	6.169	80.071	6.396	82.607	6.637	85.144	6.891	87.682	7.159	90.221	7.440	92.760	7.734	95.299	8.042	97.838	8.364	100.378	8.699	102.917	9.047	105.456	9.409	107.995	9.784	155	65 (P)*
125	70.384	5.738	72.922	6.018	75.461	6.316	78.001	6.630	80.540	6.960	83.079	7.308	85.618	7.671	88.157	8.051	90.695	8.448	93.232	8.861	95.768	9.290	98.302	9.735	100.836	10.196	125	
100	64.432	5.568	66.971	5.918	69.510	6.287	72.048	6.678	74.586	7.088	77.121	7.520	79.655	7.971	82.187	8.442	84.717	8.933	87.244	9.444	89.768	9.975	92.289	10.525	94.807	11.095	100	
90	62.051	5.583	64.590	5.970	67.127	6.380	69.663	6.812	72.196	7.266	74.728	7.743	77.257	8.242	79.782	8.763	82.304	9.306	84.823	9.870	87.337	10.455	89.846	11.062	92.351	11.690	90	50 (P)*
80	59.668	5.671	62.204	6.104	64.737	6.563	67.268	7.047	69.795	7.555	72.319	8.089	74.839	8.646	77.354	9.228	79.864	9.833	82.368	10.462	84.866	11.115	87.358	11.791	89.842	12.489	80	50 (H)**
70	57.278	5.861	59.808	6.354	62.333	6.875	64.854	7.424	67.370	8.000	69.881	8.604	72.384	9.235	74.881	9.892	77.370	10.576	79.851	11.286	82.323	12.022	84.786	12.782	87.239	13.568	70	
60	54.870	6.204	57.387	6.773	59.898	7.375	62.401	8.008	64.896	8.672	67.382	9.367	69.858	10.092	72.323	10.846	74.776	11.629	77.217	12.441	79.646	13.281	82.060	14.148	84.460	15.042	60	40 (P)*
55	53.652	6.456	56.159	7.073	58.657	7.725	61.146	8.410	63.624	9.128	66.091	9.878	68.545	10.660	70.985	11.473	73.412	12.317	75.823	13.190	78.218	14.092	80.596	15.022	82.956	15.980	55	
50	52.417	6.782	54.909	7.455	57.390	8.165	59.859	8.911	62.313	9.691	64.753	10.506	67.177	11.354	69.585	12.234	71.974	13.146	74.344	14.089	76.694	15.061	79.022	16.062	81.329	17.090	50	40 (H)**
45	51.156	7.204	53.627	7.943	56.082	8.722	58.521	9.539	60.943	10.392	63.345	11.281	65.726	12.205	68.087	13.163	70.424	14.152	72.737	15.173	75.025	16.224	77.287	17.303	79.521	18.410	45	35 (P)*
40	49.851	7.753	52.289	8.572	54.707	9.432	57.102	10.332	59.475	11.271	61.822	12.247	64.143	13.258	66.436	14.303	68.699	15.381	70.932								40	30 (H)**
35	48.469	8.475	50.857	9.389	53.217	10.346	55.547	11.345	57.846	12.383	60.112	13.458															35	
33	47.883	8.825	50.243	9.783	52.572	10.784	54.866	11.827	57.126	12.908																	33	30 (P)*
30	46.949	9.435	49.256	10.463	51.524	11.535																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 28 Degrees

$\Delta = 28°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	630.821	76.539	633.321	76.542	635.822	76.546	638.323	76.550	640.825	76.556	643.326	76.562	645.828	76.570	648.330	76.578	650.832	76.587	653.334	76.597	655.837	76.607	658.340	76.619	660.843	76.631	2500	
2200	556.022	67.355	558.523	67.358	561.024	67.363	563.525	67.368	566.027	67.375	568.529	67.382	571.031	67.390	573.533	67.399	576.035	67.410	578.538	67.421	581.041	67.433	583.544	67.446	586.048	67.460	2200	
2000	506.157	61.233	508.658	61.236	511.159	61.241	513.660	61.247	516.162	61.254	518.664	61.262	521.166	61.271	523.669	61.281	526.171	61.293	528.674	61.305	531.177	61.319	533.681	61.333	536.184	61.349	2000	
1800	456.292	55.110	458.792	55.115	461.294	55.120	463.795	55.126	466.297	55.134	468.799	55.143	471.302	55.153	473.804	55.165	476.307	55.177	478.811	55.191	481.314	55.206	483.818	55.222	486.322	55.239	1800	
1500	381.493	45.927	383.995	45.932	386.496	45.939	388.998	45.947	391.500	45.956	394.003	45.967	396.506	45.979	399.009	45.992	401.512	46.007	404.016	46.024	406.521	46.042	409.025	46.061	411.530	46.082	1500	
1200	306.695	36.745	309.197	36.751	311.699	36.759	314.201	36.769	316.704	36.781	319.207	36.794	321.711	36.809	324.215	36.826	326.719	36.845	329.224	36.865	331.729	36.888	334.235	36.912	336.741	36.938	1200	
1000	256.830	30.624	259.332	30.631	261.834	30.641	264.337	30.653	266.840	30.667	269.344	30.683	271.849	30.701	274.353	30.721	276.859	30.744	279.364	30.768	281.871	30.795	284.377	30.824	286.885	30.855	1000	
900	231.898	27.563	234.400	27.572	236.902	27.583	239.405	27.595	241.909	27.611	244.413	27.629	246.918	27.649	249.423	27.672	251.929	27.697	254.436	27.724	256.942	27.754	259.450	27.786	261.958	27.821	900	
800	206.965	24.503	209.467	24.512	211.970	24.525	214.474	24.540	216.978	24.557	219.483	24.577	221.988	24.600	224.494	24.625	227.000	24.653	229.508	24.684	232.015	24.718	234.524	24.754	237.033	24.793	800	
700	182.033	21.444	184.535	21.454	187.039	21.468	189.543	21.485	192.047	21.505	194.553	21.528	197.059	21.554	199.565	21.583	202.073	21 615	204.581	21.651	207.090	21.689	209.599	21.730	212.109	21.775	700	100 (P)*
600	157.101	18.385	159.604	18.397	162.107	18.413	164.612	18.433	167.117	18.456	169.624	18.483	172.131	18.513	174.639	18.547	177.147	18.585	179.657	18.626	182.167	18.671	184.678	18.719	187.189	18.771	600	
500	132.169	15.326	134.672	15.341	137.177	15.361	139.682	15.384	142.189	15.412	144.696	15.444	147.204	15.481	149.714	15.521	152.224	15.567	154.735	15.616	157.247	15.670	159.760	15.728	162.274	15.790	500	
400	107.237	12.270	109.741	12.289	112.247	12.313	114.754	12.342	117.262	12.377	119.771	12.417	122.281	12.463	124.793	12.514	127.305	12.570	129.819	12.632	132.334	12.699	134.849	12.771	137.366	12.849	400	
360	97.264	11.048	99.769	11.069	102.276	11.095	104.783	11.128	107.292	11.167	109.802	11.212	112.314	11.262	114.826	11.319	117.340	11.382	119.855	11.450	122.371	11.525	124.888	11.605	127.407	11.692	360	
350	94.771	10.742	97.276	10.764	99.783	10.792	102.291	10.825	104.800	10.865	107.310	10.911	109.822	10.963	112.335	11.021	114.849	11.086	117.364	11.156	119.881	11.233	122.398	11.316	124.917	11.405	350	
300	82.306	9.216	84.812	9.241	87.319	9.274	89.828	9.313	92.339	9.360	94.851	9.413	97.364	9.474	99.879	9.542	102.395	9.617	104.913	9.699	107.432	9.789	109.952	9.885	112.473	9.989	300	80 (P)*
250	69.841	7.692	72.348	7.722	74.857	7.761	77.368	7.808	79.880	7.864	82.394	7.928	84.910	8.001	87.427	8.083	89.947	8.173	92.467	8.271	94.989	8.379	97.513	8.495	100.037	8.619	250	
230	64.853	7.083	67.363	7.116	69.872	7.158	72.384	7.209	74.897	7.270	77.413	7.340	79.930	7.419	82.448	7.508	84.969	7.606	87.491	7.713	90.014	7.829	92.540	7.955	95.066	8.090	230	
200	57.377	6.171	59.885	6.209	62.396	6.257	64.910	6.316	67.425	6.386	69.942	6.466	72.461	6.557	74.982	6.659	77.505	6.772	80.030	6.895	82.556	7.029	85.084	7.174	87.613	7.329	200	
170	49.899	5.261	52.409	5.305	54.922	5.362	57.437	5.432	59.954	5.514	62.474	5.608	64.996	5.716	67.520	5.835	70.046	5.968	72.574	6.113	75.104	6.270	77.635	6.440	80.168	6.623	170	65 (P)*
155	46.160	4.807	48.671	4.856	51.183	4.918	53.701	4.994	56.220	5.084	58.742	5.188	61.266	5.306	63.792	5.437	66.320	5.582	68.849	5.741	71.381	5.914	73.914	6.100	76.449	6.300	155	
125	38.684	3.904	41.197	3.964	43.714	4.041	46.234	4.136	48.756	4.247	51.282	4.376	53.810	4.522	56.340	4.684	58.873	4.864	61.407	5.061	63.943	5.275	66.481	5.505	69.020	5.753	125	
100	32.455	3.158	34.971	3.233	37.491	3.330	40.015	3.448	42.542	3.587	45.072	3.747	47.605	3.929	50.140	4.133	52.677	4.357	55.216	4.602	57.756	4.869	60.297	5.156	62.839	5.465	100	
90	29.964	2.863	32.482	2.946	35.004	3.053	37.529	3.184	40.059	3.339	42.591	3.517	45.126	3.719	47.663	3.945	50.202	4.194	52.743	4.466	55.284	4.762	57.826	5.081	60.369	5.423	90	50 (P)*
80	27.473	2.570	29.993	2.664	32.517	2.784	35.045	2.932	37.577	3.106	40.112	3.306	42.649	3.533	45.189	3.786	47.729	4.066	50.271	4.372	52.814	4.704	55.356	5.061	57.898	5.445	80	50 (H)**
70	24.983	2.281	27.505	2.388	30.032	2.526	32.563	2.694	35.098	2.893	37.635	3.122	40.175	3.381	42.716	3.670	45.259	3.989	47.801	4.337	50.343	4.715	52.884	5.122	55.423	5.559	70	
60	22.492	1.992	25.020	2.123	27.550	2.283	30.084	2.480	32.622	2.711	35.162	2.977	37.703	3.279	40.246	3.615	42.788	3.986	45.329	4.390	47.868	4.829	50.405	5.301	52.937	5.807	60	40 (P)*
55	21.251	1.859	23.777	1.996	26.309	2.171	28.845	2.385	31.385	2.637	33.926	2.927	36.468	3.255	39.011	3.621	41.552	4.025	44.091	4.465	46.627	4.942	49.158	5.455	51.684	6.003	55	
50	20.007	1.724	22.536	1.874	25.070	2.066	27.608	2.301	30.149	2.578	32.691	2.897	35.233	3.257	37.774	3.659	40.313	4.101	42.848	4.583	45.379	5.105	47.903	5.666	50.420	6.266	50	40 (H)**
45	18.765	1.592	21.296	1.759	23.832	1.972	26.371	2.233	28.913	2.540	31.456	2.894	33.997	3.293	36.536	3.737	39.070	4.226	41.599	4.759	44.120	5.335	46.633	5.954	49.135	6.614	45	35 (P)*
40	17.523	1.466	20.056	1.653	22.594	1.893	25.136	2.186	27.678	2.531	30.219	2.927	32.758	3.374	35.291	3.871	37.818	4.418	40.336	5.013	42.843	5.655	45.337	6.343	47.817	7.077	40	35 (H) 30 (P)*
35	16.282	1.347	18.818	1.561	21.358	1.835	23.900	2.169	26.442	2.561	28.980	3.012	31.512	3.520	34.036	4.083	36.549	4.702	39.048	5.374	41.531	6.098	43.995	6.873	46.439	7.697	35	
33	15.786	1.303	18.323	1.529	20.864	1.819	23.406	2.173	25.947	2.588	28.483	3.065	31.011	3.602	33.528	4.198	36.032	4.850	38.521	5.559	40.990	6.332	43.438	7.136	45.862	8.001	33	
30	15.042	1.240	17.581	1.489	20.123	1.808	22.665	2.195	25.202	2.651	27.733	3.173	30.252	3.759	32.757	4.409	35.244	5.121	37.710	5.891	40.152	6.719	42.567	7.601	44.952	8.535	30	30 (H)**
25	13.804	1.151	16.345	1.449	18.887	1.829	21.424	2.292	23.951	2.833	26.464	3.452	28.957	4.145	31.425	4.909	33.865	5.742	36.271	6.641	38.639	7.600	40.966	8.617	43.248	9.687	25	
23	13.309	1.121	15.851	1.446	18.392	1.859	20.925	2.359	23.444	2.945	25.944	3.612	28.420	4.358	30.864	5.180	33.274	6.072	35.642	7.032	37.965	8.053	40.239	9.132			23	25 (P)*
20	12.568	1.093	15.110	1.463	17.646	1.936	20.168	2.506	22.669	3.172	25.140	3.928	27.576	4.769	29.968	5.690	32.311	6.686	34.599	7.750							20	25 (H)**
15	11.332	1.098	13.866	1.586	16.378	2.205	18.855	2.946	21.284	3.801	23.652	4.760	25.949	5.812													15	20 (P)*
14	11.085	1.112	13.614	1.633	16.116	2.292	18.576	3.079	20.978	3.983	23.309	4.994															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 28°$

Deviation Angle = 28 Degrees

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	663.346	76.645	665.849	76.659	668.353	76.674	670.857	76.690	673.360	76.707	675.865	76.724	678.369	76.743	680.874	76.762	683.378	76.782	685.883	76.803	688.388	76.825	690.894	76.848	693.399	76.871	2500	
2200	588.551	67.474	591.055	67.491	593.559	67.509	596.063	67.527	598.568	67.546	601.072	67.566	603.577	67.587	606.083	67.609	608.588	67.632	611.093	67.656	613.599	67.680	616.105	67.706	618.611	67.733	2200	
2000	538.688	61.365	541.192	61.383	543.697	61.402	546.202	61.422	548.707	61.442	551.212	61.465	553.717	61.488	556.223	61.512	558.729	61.537	561.235	61.563	563.741	61.591	566.248	61.619	568.755	61.648	2000	
1800	488.826	55.258	491.331	55.277	493.836	55.298	496.341	55.320	498.847	55.344	501.352	55.368	503.858	55.394	506.365	55.421	508.871	55.448	511.378	55.478	513.885	55.508	516.392	55.540	518.900	55.573	1800	
1500	414.035	46.104	416.541	46.128	419.047	46.153	421.553	46.179	424.059	46.207	426.566	46.236	429.073	46.267	431.580	46.300	434.088	46.333	436.596	46.368	439.105	46.405	441.613	46.442	444.122	46.482	1500	
1200	339.247	36.966	341.754	36.995	344.261	37.027	346.769	37.060	349.277	37.094	351.785	37.131	354.294	37.170	356.803	37.210	359.313	37.252	361.823	37.296	364.333	37.341	366.844	37.389	369.355	37.438	1200	
1000	289.392	30.889	291.900	30.924	294.409	30.962	296.918	31.001	299.427	31.043	301.938	31.087	304.448	31.134	306.959	31.182	309.470	31.232	311.982	31.285	314.494	31.340	317.007	31.396	319.520	31.455	1000	
900	264.466	27.858	266.975	27.897	269.485	27.939	271.995	27.983	274.505	28.030	277.016	28.078	279.528	28.130	282.040	28.183	284.552	28.240	287.065	28.298	289.579	28.359	292.093	28.422	294.607	28.488	900	
800	239.542	24.834	242.052	24.879	244.563	24.926	247.074	24.976	249.586	25.028	252.098	25.083	254.611	25.141	257.124	25.201	259.638	25.264	262.152	25.330	264.667	25.398	267.183	25.469	269.699	25.543	800	
700	214.620	21.822	217.131	21.873	219.644	21.927	222.156	21.983	224.669	22.043	227.183	22.106	229.698	22.172	232.213	22.241	234.728	22.313	237.245	22.388	239.762	22.466	242.279	22.547	244.797	22.632	700	
600	189.702	18.826	192.215	18.885	194.729	18.948	197.243	19.014	199.758	19.084	202.274	19.157	204.791	19.234	207.308	19.315	209.826	19.399	212.345	19.486	214.864	19.577	217.384	19.672	219.904	19.770	600	
500	164.788	15.856	167.304	15.927	169.820	16.002	172.337	16.082	174.855	16.166	177.374	16.253	179.893	16.346	182.413	16.442	184.934	16.543	187.456	16.648	189.978	16.758	192.501	16.871	195.025	16.989	500	
400	139.884	12.932	142.403	13.021	144.922	13.115	147.443	13.214	149.965	13.318	152.487	13.428	155.011	13.544	157.535	13.664	160.060	13.790	162.586	13.922	165.112	14.058	167.640	14.200	170.168	14.348	400	
360	129.926	11.784	132.447	11.882	134.968	11.987	137.491	12.097	140.014	12.213	142.539	12.335	145.064	12.463	147.590	12.597	150.118	12.737	152.646	12.883	155.175	13.035	157.704	13.192	160.235	13.356	360	100 (P)*
350	127.437	11.500	129.958	11.601	132.480	11.708	135.003	11.822	137.527	11.941	140.052	12.067	142.578	12.198	145.105	12.336	147.633	12.480	150.162	12.630	152.691	12.786	155.221	12.948	157.752	13.116	350	
300	114.996	10.100	117.520	10.218	120.045	10.343	122.571	10.475	125.098	10.614	127.626	10.760	130.155	10.914	132.685	11.075	135.216	11.242	137.748	11.417	140.281	11.599	142.815	11.788	145.349	11.984	300	
250	102.564	8.752	105.091	8.893	107.620	9.043	110.149	9.202	112.680	9.369	115.212	9.544	117.745	9.728	120.279	9.921	122.814	10.122	125.350	10.331	127.886	10.549	130.424	10.776	132.962	11.011	250	
230	97.594	8.235	100.123	8.389	102.653	8.551	105.185	8.724	107.718	8.905	110.251	9.096	112.786	9.296	115.322	9.505	117.858	9.723	120.396	9.951	122.934	10.188	125.473	10.433	128.012	10.689	230	80 (P)*
200	90.144	7.495	92.676	7.672	95.210	7.859	97.744	8.057	100.280	8.265	102.816	8.484	105.354	8.714	107.892	8.954	110.432	9.205	112.971	9.466	115.512	9.738	118.053	10.020	120.594	10.313	200	
170	82.702	6.818	85.238	7.025	87.775	7.245	90.312	7.478	92.851	7.723	95.391	7.980	97.931	8.249	100.472	8.531	103.014	8.826	105.555	9.132	108.098	9.451	110.640	9.782	113.183	10.125	170	
155	78.985	6.514	81.522	6.741	84.061	6.982	86.600	7.237	89.141	7.505	91.682	7.787	94.223	8.082	96.765	8.391	99.307	8.713	101.850	9.049	104.392	9.398	106.935	9.760	109.477	10.136	155	65 (P)*
125	71.560	6.017	74.101	6.299	76.642	6.597	79.184	6.911	81.727	7.243	84.269	7.590	86.812	7.955	89.354	8.336	91.895	8.733	94.436	9.147	96.976	9.577	99.514	10.023	102.051	10.485	125	
100	65.381	5.794	67.924	6.144	70.466	6.515	73.008	6.906	75.549	7.317	78.088	7.749	80.626	8.202	83.163	8.674	85.697	9.166	88.229	9.678	90.757	10.210	93.283	10.761	95.806	11.332	100	
90	62.911	5.787	65.453	6.175	67.994	6.586	70.533	7.019	73.071	7.474	75.607	7.952	78.140	8.452	80.670	8.974	83.198	9.518	85.721	10.083	88.240	10.670	90.755	11.278	93.266	11.908	90	50 (P)*
80	60.439	5.854	62.978	6.288	65.516	6.748	68.051	7.233	70.583	7.743	73.111	8.277	75.636	8.836	78.156	9.418	80.671	10.025	83.181	10.656	85.685	11.310	88.183	11.987	90.674	12.687	80	50 (H)**
70	57.960	6.024	60.494	6.517	63.025	7.039	65.551	7.589	68.072	8.167	70.588	8.772	73.097	9.404	75.600	10.063	78.095	10.749	80.582	11.460	83.061	12.197	85.531	12.959	87.990	13.746	70	
60	55.465	6.345	57.987	6.916	60.504	7.519	63.013	8.153	65.513	8.819	68.006	9.515	70.488	10.242	72.960	10.998	75.420	11.783	77.869	12.596	80.305	13.438	82.727	14.307	85.134	15.202	60	40 (P)*
55	54.204	6.587	56.717	7.206	59.221	7.859	61.716	8.545	64.201	9.265	66.674	10.017	69.135	10.801	71.583	11.616	74.017	12.461	76.436	13.336	78.839	14.240	81.225	15.172	83.594	16.131	55	
50	52.928	6.903	55.426	7.578	57.913	8.290	60.389	9.037	62.850	9.819	65.298	10.635	67.729	11.485	70.144	12.367	72.542	13.281	74.920	14.226	77.279	15.200	79.617	16.203	81.933	17.233	50	40 (H)**
45	51.626	7.315	54.103	8.057	56.565	8.837	59.012	9.655	61.441	10.510	63.851	11.402	66.241	12.327	68.610	13.287	70.956	14.279	73.278	15.302	75.575	16.355	77.847	17.436	80.091	18.545	45	35 (P)*
40	50.280	7.855	52.726	8.676	55.151	9.538	57.555	10.440	59.936	11.380	62.292	12.358	64.622	13.372	66.924	14.419	69.197	15.499	71.440	16.610							40	30 (H)**
35	48.860	8.567	51.256	9.484	53.625	10.443	55.964	11.444	58.272	12.484	60.548	13.562															35	
33	48.259	8.915	50.628	9.874	52.965	10.878	55.270	11.922	57.539	13.007																	33	30 (P)*
30	47.304	9.519	49.620	10.550	51.898	11.624																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=29°

Deviation Angle = 29 Degrees

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	654.044	82.253	656.545	82.256	659.046	82.260	661.547	82.265	664.049	82.271	666.550	82.277	669.052	82.284	671.554	82.293	674.056	82.302	676.559	82.312	679.061	82.322	681.564	82.334	684.067	82.346	2500	
2200	576.459	72.384	578.960	72.387	581.461	72.392	583.963	72.397	586.464	72.404	588.966	72.411	591.468	72.419	593.970	72.429	596.473	72.439	598.976	72.450	601.479	72.462	603.982	42.476	606.485	72.490	2200	
2000	524.736	65.804	527.237	65.808	529.738	65.813	532.240	65.819	534.741	65.826	537.243	65.834	539.746	65.843	542.248	65.854	544.751	65.865	547.254	65.877	549.757	65.891	552.261	65.905	554.764	65.921	2000	
1800	473.012	59.225	475.514	59.229	478.015	59.235	480.517	59.241	483.019	59.249	485.521	59.258	488.023	59.268	490.526	59.280	493.029	59.292	495.532	59.306	498.036	59.321	500.540	59.337	503.044	59.354	1800	
1500	395.428	49.356	397.929	49.361	400.430	49.368	402.932	49.375	405.435	49.385	407.937	49.396	410.440	49.408	412.944	49.421	415.448	49.437	417.951	49.453	420.456	49.471	422.960	49.490	425.466	49.511	1500	
1200	317.843	39.488	320.344	39.494	322.846	39.502	325.349	39.512	327.852	39.524	330.355	39.537	332.859	39.552	335.363	39.570	337.867	39.588	340.372	39.609	342.878	39.631	345.384	39.656	347.890	39.682	1200	
1000	266.120	32.909	268.622	32.917	271.124	32.927	273.627	32.939	276.130	32.953	278.634	32.969	281.139	32.987	283.644	33.008	286.149	33.030	288.655	33.055	291.162	33.082	293.669	33.111	296.176	33.142	1000	
900	240.258	29.621	242.760	29.629	245.263	29.640	247.766	29.653	250.270	29.668	252.774	29.686	255.279	29.707	257.785	29.729	260.291	29.755	262.798	29.782	265.305	29.812	267.813	29.844	270.321	29.879	900	
800	214.397	26.332	216.899	26.341	219.402	26.354	221.906	26.368	224.410	26.386	226.915	26.406	229.421	26.429	231.927	26.454	234.434	26.482	236.941	26.514	239.449	26.547	241.958	26.583	244.467	26.623	800	
700	188.536	23.044	191.038	23.055	193.542	23.068	196.046	23.085	198.551	23.105	201.056	23.128	203.563	23.155	206.070	23.184	208.577	23.216	211.086	23.251	213.595	23.290	216.105	23.331	218.615	23.376	700	100 (P)*
600	162.674	19.756	165.178	19.769	167.681	19.785	170.186	19.804	172.692	19.828	175.198	19.855	177.706	19.885	180.214	19.919	182.723	19.957	185.233	19.998	187.743	20.043	190.254	20.092	192.767	20.143	600	
500	136.813	16.469	139.317	16.484	141.822	16.504	144.328	16.527	146.834	16.555	149.342	16.588	151.851	16.624	154.360	16.665	156.871	16.710	159.383	16.760	161.895	16.813	164.409	16.872	166.923	16.934	500	
400	110.953	13.184	113.458	13.203	115.963	13.227	118.470	13.257	120.979	13.292	123.488	13.332	125.999	13.378	128.511	13.429	131.024	13.485	133.538	13.547	136.054	13.614	138.570	13.687	141.087	13.765	400	
360	100.609	11.871	103.114	11.892	105.620	11.919	108.128	11.952	110.638	11.990	113.148	12.035	115.660	12.086	118.173	12.143	120.687	12.206	123.203	12.274	125.720	12.349	128.238	12.429	130.757	12.516	360	
350	98.023	11.543	100.528	11.564	103.035	11.592	105.543	11.626	108.052	11.666	110.563	11.712	113.075	11.764	115.589	11.822	118.104	11.887	120.620	11.958	123.137	12.034	125.655	12.117	128.175	12.206	350	
300	85.093	9.902	87.599	9.927	90.107	9.960	92.616	9.999	95.127	10.046	97.640	10.099	100.154	10.160	102.669	10.229	105.186	10.304	107.704	10.386	110.224	10.476	112.745	10.573	115.268	10.677	300	80 (P)*
250	72.164	8.264	74.671	8.294	77.180	8.333	79.691	8.380	82.204	8.436	84.719	8.500	87.236	8.573	89.754	8.655	92.274	8.746	94.795	8.844	97.318	8.952	99.843	9.068	102.368	9.193	250	
230	66.992	7.605	69.500	7.642	72.010	7.684	74.522	7.735	77.036	7.796	79.552	7.866	82.070	7.946	84.589	8.035	87.111	8.133	89.634	8.240	92.158	8.357	94.684	8.483	97.212	8.619	230	
200	59.235	6.628	61.744	6.666	64.256	6.714	66.769	6.774	69.285	6.844	71.803	6.924	74.323	7.016	76.845	7.118	79.369	7.230	81.895	7.354	84.422	7.488	86.951	7.633	89.482	7.789	200	
170	51.479	5.650	53.989	5.694	56.502	5.751	59.018	5.821	61.536	5.903	64.057	5.998	66.580	6.105	69.105	6.225	71.633	6.358	74.162	6.503	76.693	6.661	79.226	6.832	81.760	7.015	170	65 (P)*
155	47.601	5.162	50.112	5.211	52.626	5.273	55.144	5.349	57.663	5.439	60.186	5.543	62.711	5.661	65.238	5.793	67.767	5.938	70.298	6.098	72.831	6.271	75.366	6.458	77.903	6.658	155	
125	39.846	4.190	42.360	4.250	44.877	4.328	47.398	4.422	49.921	4.534	52.448	4.663	54.977	4.809	57.509	4.972	60.043	5.152	62.579	5.349	65.117	5.564	67.657	5.795	70.198	6.043	125	
100	33.385	3.387	35.901	3.462	38.423	3.559	40.947	3.677	43.476	3.817	46.007	3.978	48.542	4.160	51.079	4.364	53.618	4.588	56.159	4.834	58.701	5.101	61.245	5.390	63.790	5.699	100	
90	30.801	3.069	33.319	3.152	35.842	3.260	38.369	3.391	40.900	3.546	42.434	3.725	45.971	3.927	48.510	4.153	51.051	4.403	53.594	4.676	56.138	4.972	58.683	5.292	61.229	5.634	90	50 (P)*
80	28.217	2.753	30.738	2.847	33.263	2.968	35.793	3.116	38.326	3.290	40.863	3.491	43.402	3.718	45.944	3.972	48.487	4.253	51.032	4.559	53.577	4.892	56.123	5.250	58.668	5.634	80	50 (H)**
70	25.635	2.441	28.158	2.549	30.686	2.687	33.219	2.855	35.755	3.054	38.295	3.284	40.837	3.543	43.380	3.833	45.925	4.153	48.471	4.502	51.016	4.881	53.561	5.289	56.104	5.726	70	
60	23.054	2.135	25.580	2.261	28.111	2.422	30.647	2.618	33.187	2.850	35.729	3.117	38.274	3.419	40.819	3.756	43.365	4.128	45.910	4.533	48.453	4.973	50.993	5.446	53.530	5.953	60	40 (P)*
55	21.763	1.985	24.291	2.122	26.825	2.298	29.263	2.512	31.904	2.765	34.448	3.056	36.993	3.385	39.539	3.751	42.084	4.156	44.627	4.597	47.167	5.075	49.703	5.589	52.234	6.139	55	
50	20.474	1.839	23.004	1.989	25.539	2.182	28.079	2.417	30.623	2.695	33.168	3.014	35.713	3.375	38.258	3.778	40.801	4.221	43.340	4.704	45.875	5.227	48.405	5.790	50.927	6.391	50	40 (H)**
45	19.185	1.695	21.717	1.862	24.255	2.077	26.797	2.338	29.342	2.646	31.887	3.000	34.432	3.400	36.975	3.845	39.514	4.335	42.047	4.869	44.574	5.447	47.092	6.067	49.600	6.729	45	35 (P)*
40	17.896	1.558	20.431	1.745	22.972	1.986	25.516	2.279	28.061	2.625	30.606	3.022	33.149	3.470	35.687	3.969	38.218	4.516	40.741	5.112	43.254	5.756	45.755	6.446	48.241	7.182	40	35 (H) 30 (P)*
35	16.609	1.428	19.147	1.642	21.690	1.917	24.236	2.251	26.781	2.644	29.323	3.096	31.860	3.605	34.388	4.170	36.906	4.790	39.411	5.464	41.901	6.190	44.373	6.966	46.824	7.791	35	
33	16.095	1.379	18.634	1.606	21.178	1.897	23.723	2.251	26.268	2.667	28.808	3.145	31.341	3.683	33.863	4.280	36.374	4.934	38.868	5.645	41.344	6.409	43.800	7.225	46.231	8.092	33	
30	15.324	1.309	17.865	1.559	20.410	1.878	22.955	2.267	25.497	2.723	28.032	3.246	30.556	3.834	33.067	4.486	35.561	5.199	38.034	5.971	40.483	6.800	42.906	7.684	45.299	8.621	30	30 (H)**
25	14.040	1.209	16.584	1.507	19.129	1.889	21.670	2.352	24.202	2.895	26.720	3.515	29.219	4.209	31.695	4.976	34.142	5.811	36.556	6.711	38.933	7.672	41.269	8.691	43.561	9.764	25	
23	13.527	1.176	16.072	1.500	18.616	1.914	21.153	2.415	23.678	3.002	26.184	3.671	28.666	4.419	31.118	5.242	33.536	6.137	35.913	7.098	38.245	8.122	40.529	9.203			23	25 (P)*
20	12.758	1.140	15.303	1.511	17.843	1.984	20.371	2.556	22.877	3.223	25.356	3.981	27.799	4.824	30.200	5.747	32.552	6.745	34.849	7.811							20	25 (H)**
15	11.477	1.133	14.016	1.623	16.533	2.243	19.017	2.985	21.453	3.842	23.830	4.803	26.137	5.858													15	20 (P)*
14	11.221	1.145	13.755	1.668	16.263	2.328	18.730	3.117	21.140	4.023	23.480	5.036															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 29 Degrees

$\Delta = 29°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	686.571	82.360	689.074	82.374	691.578	82.389	694.082	82.405	696.586	82.422	699.090	82.439	701.594	82.458	704.099	82.477	706.604	82.498	709.110	82.519	711.615	82.541	714.120	82.563	716.626	82.587	2500	
2200	608.989	72.505	611.493	72.521	613.997	72.538	616.502	72.556	619.006	72.575	621.511	72.595	624.016	72.616	626.522	72.638	629.027	72.661	631.533	72.685	634.039	72.710	636.545	72.736	639.052	72.763	2200	
2000	557.269	65.938	559.773	65.955	562.278	65.974	564.782	65.994	567.288	66.015	569.793	66.037	572.298	66.060	574.804	66.084	577.311	66.110	579.817	66.136	582.323	66.163	584.830	66.192	587.337	66.221	2000	
1800	505.549	59.373	508.054	59.393	510.559	59.413	513.064	59.436	515.570	59.459	518.076	59.483	520.582	59.509	523.088	59.536	525.595	59.564	528.102	59.593	530.609	59.624	533.117	59.656	535.625	59.688	1800	
1500	427.971	49.533	430.477	49.557	432.983	49.582	435.490	49.609	437.996	49.637	440.503	49.666	443.010	49.697	445.518	49.729	448.026	49.763	450.535	49.798	453.043	49.835	455.552	49.873	458.062	49.912	1500	
1200	350.397	39.709	352.904	39.739	355.411	39.770	357.919	39.803	360.428	39.838	362.936	39.875	365.446	39.914	367.955	39.954	370.465	39.996	372.976	40.040	375.486	40.086	377.997	40.134	380.509	40.183	1200	
1000	298.684	33.175	301.193	33.211	303.702	33.248	306.211	33.288	308.721	33.330	311.231	33.374	313.742	33.421	316.253	33.469	318.765	33.520	321.278	33.572	323.790	33.627	326.303	33.684	328.817	33.743	1000	
900	272.830	29.916	275.339	29.955	277.849	29.997	280.359	30.041	282.870	30.088	285.382	30.137	287.894	30.188	290.406	30.242	292.919	30.298	295.433	30.357	297.947	30.418	300.461	30.481	302.976	30.547	900	
800	246.977	26.664	249.487	26.708	251.998	26.756	254.510	26.805	257.022	26.858	259.535	26.913	262.048	26.971	264.562	27.031	267.076	27.094	269.592	27.160	272.107	27.229	274.623	27.300	277.140	27.374	800	
700	221.126	23.423	223.638	23.474	226.151	23.528	228.664	23.585	231.178	23.645	233.692	23.708	236.207	23.773	238.723	23.843	241.239	23.915	243.756	23.990	246.274	24.069	248 792	24.150	251.310	24.235	700	
600	195.279	20.199	197.793	20.258	200.307	20.321	202.823	20.387	205.338	20.457	207.855	20.531	210.372	20.608	212.890	20.688	215.409	20.772	217.928	20.860	220.448	20.952	222.969	21.047	225.490	21.145	600	
500	169.438	17.001	171.954	17.072	174.471	17.147	176.989	17.227	179.507	17.310	182.027	17.399	184.547	17.491	187.068	17.588	189.590	17.689	192.113	17.794	194.636	17.904	197.160	18.018	199.685	18.136	500	
400	143.606	13.848	146.125	13.937	148.646	14.031	151.168	14.131	153.690	14.235	156 214	14.345	158.738	14.461	161.263	14.582	163.790	14.708	166.317	14.840	168.845	14.977	171.373	15.119	173.903	15.267	400	
360	133.277	12.609	135.799	12.707	138.321	12.812	140.845	12.922	143.369	13.039	145.895	13.161	148.421	13.289	150.949	13.424	153.477	13.564	156.007	13.710	158.537	13.862	161.068	14.020	163.600	14.184	360	100 (P)*
350	130.696	12.302	133.218	12.403	135.740	12.510	138.265	12.624	140.790	12.744	143.316	12.870	145.843	13.001	148.371	13.140	150.900	13.284	153.430	13.434	155.961	13.591	158.493	13.753	161.025	13.922	350	
300	117.791	10.788	120.316	10.906	122.842	11.031	125.369	11.164	127.898	11.303	130.427	11.450	132.958	11.604	135.489	11.765	138.022	11.933	140.555	12.108	143.090	12.290	145.625	12.480	148.161	12.676	300	
250	104.896	9.326	107.425	9.468	109.955	9.618	112.486	9.777	115.018	9.944	117.552	10.120	120.086	10.304	122.622	10.497	125.159	10.699	127.696	10.909	130.235	11.127	132.774	11.354	135.314	11.590	250	
230	99.741	8.763	102.272	8.917	104.804	9.081	107.337	9.253	109.871	9.435	112.407	9.626	114.943	9.826	117.481	10.036	120.019	10.255	122.559	10.483	125.099	10.720	127.640	10.967	130.182	11.222	230	80 (P)*
200	92.015	7.955	94.548	8.132	97.083	8.320	99.620	8.518	102.157	8.727	104.696	8.947	107.235	9.177	109.776	9.417	112.317	9.669	114.859	9.931	117.402	10.203	119.946	10.486	122.490	10.779	200	
170	84.296	7.210	86.833	7.418	89.372	7.638	91.912	7.871	94.453	8.117	96.995	8.375	99.538	8.645	102.081	8.927	104.625	9.222	107.170	9.530	109.715	9.849	112.261	10.181	114.806	10.525	170	
155	80.441	6.872	82.980	7.100	85.521	7.342	88.063	7.597	90.605	7.866	93.149	8.148	95.693	8.443	98.238	8.754	100.783	9.076	103.328	9.413	105.874	9.763	108.420	10.126	110.965	10.502	155	65 (P)*
125	72.741	6.308	75.284	6.590	77.829	6.888	80.373	7.204	82.919	7.536	85.464	7.885	88.010	8.250	90.555	8.632	93.101	9.030	95.645	9.444	98.189	9.875	100.731	10.322	103.273	10.786	125	
100	66.335	6.029	68.881	6.379	71.426	6.751	73.971	7.143	76.516	7.556	79.059	7.988	81.602	8.442	84.142	8.915	86.681	9.408	89.217	9.922	91.751	10.455	94.282	11.007	96.809	11.579	100	
90	63.775	6.000	66.320	6.389	68.864	6.800	71.408	7.234	73.950	7.691	76.490	8.169	79.028	8.671	81.563	9.194	84.095	9.739	86.623	10.305	89.148	10.894	91.668	11.503	94.184	12.134	90	50 (P)*
80	61.213	6.044	63.756	6.480	66.298	6.941	68.837	7.426	71.374	7.937	73.907	8.473	76.437	9.033	78.962	9.617	81.483	10.225	83.999	10.857	86.508	11.512	89.012	12.191	91.509	12.892	80	50 (H)**
70	58.646	6.192	61.184	6.687	63.719	7.210	66.250	7.761	68.776	8.340	71.298	8.947	73.813	9.580	76.321	10.241	78.823	10.928	81.317	11.641	83.802	12.379	86.278	13.143	88.745	13.932	70	
60	56.063	6.492	58.591	7.065	61.112	7.669	63.627	8.305	66.134	8.972	68.632	9.669	71.121	10.397	73.600	11.155	76.067	11.942	78.523	12.757	80.967	13.601	83.396	14.471	85.812	15.369	60	40 (P)*
55	54.759	6.724	57.278	7.344	59.788	7.998	62.289	8.686	64.780	9.408	67.260	10.161	69.728	10.947	72.184	11.763	74.625	12.610	77.052	13.487	79.463	14.393	81.858	15.327	84.235	16.289	55	
50	53.441	7.030	55.945	7.706	58.439	8.419	60.921	9.168	63.390	9.952	65.844	10.770	68.283	11.621	70.706	12.506	73.112	13.421	75.499	14.368	77.866	15.344	80.213	16.350	82.539	17.383	50	40 (H)**
45	52.097	7.432	54.581	8.174	57.051	8.956	59.504	9.776	61.941	10.634	64.359	11.527	66.758	12.455	69.135	13.416	71.490	14.410	73.822	15.436	76.128	16.491	78.410	17.575	80.664	18.686	45	35 (P)*
40	50.712	7.961	53.164	8.784	55.598	9.648	58.010	10.552	60.399	11.494	62.764	12.474	65.103	13.490	67.415	14.540	69.697	15.622	71.950	16.735							40	30 (H)**
35	49.253	8.664	51.657	9.582	54.034	10.544	56.383	11.547	58.700	12.589	60.985	13.669															35	
33	48.637	9.008	51.014	9.969	53.361	10.975	55.675	12.022	57.953	13.109																	33	30 (P)*
30	47.660	9.607	49.985	10.640	52.273	11.717																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P Plain & Rolling Terrian **H Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 30°$

Deviation Angle = 30 Degrees

R_O	$L_S = 15$ metres		$L_S = 20$ metres		$L_S = 25$ metres		$L_S = 30$ metres		$L_S = 35$ metres		$L_S = 40$ metres		$L_S = 45$ metres		$L_S = 50$ metres		$L_S = 55$ metres		$L_S = 60$ metres		$L_S = 65$ metres		$L_S = 70$ metres		$L_S = 75$ metres		R_O	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre			
2500	677.374	88.195	679.874	88.198	682.375	88.202	684.876	88.207	687.378	88.212	689.880	88.219	692.382	88.226	694.884	88.234	697.386	88.243	699.888	88.253	702.391	88.264	704.894	88.276	707.397	88.288	2500	
2200	596.989	77.612	599.490	77.616	601.991	77.620	604.492	77.626	606.994	77.632	609.496	77.639	611.998	77.648	614.500	77.657	617.003	77.667	619.506	77.679	622.009	77.691	624.512	77.704	627.016	77.718	2200	
2000	543.399	70.558	545.900	70.562	548.401	70.566	550.903	70.572	553.405	70.579	555.907	70.587	558.409	70.596	560.912	70.607	563.415	70.618	565.918	70.630	568.421	70.644	570.925	70.658	573.429	70.674	2000	
1800	489.810	63.503	492.311	63.507	494.812	63.512	497.314	63.519	499.816	63.527	502.318	63.536	504.821	63.546	507.323	63.557	509.827	63.570	512.330	63.584	514.834	63.599	517.338	63.615	519.843	63.632	1800	
1500	409.425	52.921	411.927	52.926	414.428	52.933	416.930	52.940	419.433	52.950	421.935	52.961	424.438	52.973	426.942	52.986	429.446	53.001	431.950	53.018	434.454	53.036	436.959	53.056	439.465	53.076	1500	
1200	329.041	42.340	331.542	42.346	334.045	42.354	336.547	42.364	339.050	42.376	341.553	42.389	344.057	42.405	346.562	42.422	349.066	42.440	351.572	42.461	354.077	42.484	356.583	42.508	359.090	42.534	1200	
1000	275.451	35.286	277.953	35.294	280.456	35.303	282.959	35.315	285.462	35.329	287.967	35.345	290.471	35.364	292.976	35.384	295.482	35.407	297.988	35.432	300.495	35.459	303.002	35.488	305.510	35.519	1000	
900	248.657	31.760	251.159	31.768	253.662	31.779	256.165	31.792	258.669	31.807	261.174	31.825	263.679	31.846	266.185	31.869	268.691	31.894	271.198	31.921	273.705	31.951	276.213	31.984	278.722	32.019	900	
800	221.862	28.233	224.365	28.243	226.868	28.255	229.372	28.270	231.876	28.287	234.381	28.307	236.887	28.330	239.393	28.356	241.900	28.384	244.408	28.415	246.916	28.449	249.425	28.485	251.935	28.524	800	
700	195.068	24.707	197.571	24.718	200.074	24.732	202.578	24.749	205.083	24.769	207.589	24.792	210.096	24.818	212.603	24.847	215.111	24.880	217.620	24.916	220.129	24.954	222.640	24.996	225.150	25.040	700	100 (P)*
600	168.274	21.182	170.777	21.195	173.281	21.211	175.786	21.230	178.292	21.254	180.798	21.281	183.306	21.312	185.814	21.345	188.324	21.383	190.834	21.425	193.345	21.470	195.857	21.518	198.369	21.570	600	
500	141.479	17.658	143.983	17.673	146.488	17.692	148.994	17.716	151.501	17.744	154.009	17.776	156.518	17.813	159.028	17.854	161.539	17.899	164.051	17.949	166.564	18.003	169.078	18.061	171.593	18.124	500	
400	114.686	14.135	117.191	14.154	119.697	14.178	122.204	14.208	124.713	14.243	127.223	14.283	129.734	14.329	132.246	14.380	134.760	14.437	137.274	14.499	139.790	14.566	142.307	14.639	144.826	14.717	400	
360	103.969	12.727	106.474	12.748	108.980	12.774	111.489	12.807	113.998	12.846	116.509	12.891	119.021	12.942	121.535	12.999	124.050	13.062	126.566	13.131	129.084	13.206	131.603	13.286	134.122	13.373	360	
350	101.289	12.375	103.795	12.396	106.302	12.424	108.810	12.458	111.320	12.498	113.831	12.544	116.344	12.596	118.858	12.655	121.373	12.719	123.890	12.790	126.408	12.867	128.927	12.950	131.447	13.040	350	
300	87.893	10.615	90.399	10.641	92.907	10.673	95.417	10.712	97.928	10.759	100.441	10.813	102.956	10.874	105.472	10.942	107.990	11.018	110.509	11.100	113.029	11.190	115.551	11.287	118.074	11.391	300	80 (P)*
250	74.497	8.858	77.005	8.888	79.514	8.927	82.026	8.974	84.539	9.031	87.054	9.095	89.572	9.168	92.091	9.250	94.611	9.341	97.134	9.440	99.658	9.548	102.183	9.664	104.710	9.789	250	
230	69.139	8.156	71.647	8.189	74.157	8.231	76.670	8.282	79.184	8.343	81.701	8.414	84.219	8.493	86.740	8.582	89.262	8.681	91.786	8.788	94.312	8.905	96.839	9.032	99.368	9.168	230	
200	61.102	7.104	63.611	7.142	66.123	7.190	68.637	7.249	71.154	7.319	73.672	7.400	76.193	7.492	78.716	7.594	81.241	7.707	83.768	7.831	86.297	7.966	88.827	8.111	91.360	8.267	200	
170	53.066	6.054	55.576	6.098	58.090	6.156	60.607	6.225	63.126	6.308	65.647	6.403	68.171	6.510	70.697	6.631	73.226	6.764	75.756	6.909	78.289	7.068	80.823	7.238	83.359	7.422	170	65 (P)*
155	49.048	5.530	51.560	5.579	54.074	5.642	56.592	5.718	59.113	5.809	61.636	5.913	64.162	6.031	66.690	6.163	69.221	6.309	71.754	6.468	74.288	6.642	76.825	6.829	79.363	7.030	155	
125	41.013	4.487	43.527	4.548	46.045	4.625	48.567	4.720	51.092	4.832	53.619	4.961	56.150	5.108	58.683	5.271	61.219	5.452	63.757	5.649	66.297	5.864	68.839	6.096	71.382	6.344	125	
100	34.319	3.623	36.836	3.700	39.358	3.797	41.884	3.916	44.414	4.055	46.947	4.217	49.483	4.400	52.021	4.604	54.563	4.829	57.106	5.076	59.651	5.343	62.197	5.632	64.745	5.942	100	
90	31.642	3.283	34.161	3.367	36.685	3.474	39.213	3.606	41.745	3.761	44.281	3.940	46.819	4.143	49.361	4.370	51.904	4.620	54.449	4.894	56.996	5.190	59.544	5.511	62.093	5.854	90	50 (P)*
80	28.965	2.943	31.487	3.038	34.013	3.159	36.544	3.307	39.079	3.482	41.617	3.683	44.159	3.911	46.702	4.165	49.248	4.446	51.796	4.754	54.344	5.087	56.893	5.446	59.442	5.831	80	50 (H)**
70	26.289	2.608	28.813	2.716	31.343	2.854	33.877	3.021	36.415	3.223	38.957	3.452	41.501	3.713	44.047	4.003	46.595	4.325	49.144	4.673	51.695	5.053	54.247	5.462	56.799	5.906	70	
60	23.615	2.278	26.142	2.404	28.675	2.565	31.213	2.762	33.755	2.995	36.300	3.262	38.847	3.565	41.395	3.903	43.944	4.275	46.493	4.682	49.040	5.122	51.584	5.597	54.126	6.105	60	40 (P)*
55	22.278	2.117	24.807	2.254	27.342	2.429	29.882	2.644	32.426	2.898	34.973	3.189	37.521	3.519	40.070	3.887	42.618	4.292	45.165	4.734	47.710	5.213	50.250	5.728	52.787	6.279	55	
50	20.942	1.958	23.473	2.108	26.011	2.302	28.553	2.538	31.099	2.816	33.646	3.136	36.195	3.498	38.744	3.901	41.291	4.346	43.835	4.830	46.374	5.354	48.909	5.918	51.436	6.520	50	40 (H)**
45	19.607	1.803	22.140	1.970	24.680	2.185	27.225	2.447	29.772	2.755	32.321	3.110	34.869	3.511	37.416	3.958	39.959	4.449	42.498	4.984	45.030	5.563	47.553	6.184	50.068	6.848	45	35 (P)*
40	18.272	1.653	20.809	1.841	23.351	2.083	25.898	2.377	28.446	2.723	30.995	3.121	33.542	3.570	36.084	4.070	38.621	4.619	41.149	5.216	43.668	5.861	46.174	6.553	48.667	7.290	40	35 (H) 30 (P)*
35	16.938	1.512	19.478	1.726	22.024	2.001	24.572	2.337	27.121	2.731	29.667	3.184	32.208	3.694	34.742	4.260	37.266	4.882	39.777	5.557	42.273	6.284	44.752	7.063	47.211	7.890	35	
33	16.403	1.458	18.947	1.685	21.493	1.977	24.042	2.332	26.590	2.749	29.134	3.228	31.672	3.768	34.200	4.366	36.716	5.022	39.217	5.733	41.700	6.499	44.163	7.318	46.602	8.187	33	
30	15.606	1.381	18.150	1.631	20.698	1.951	23.246	2.341	25.792	2.798	28.332	3.323	30.862	3.912	33.378	4.565	35.879	5.280	38.359	6.054	40.816	6.885	43.247	7.771	45.648	8.710	30	30 (H)**
25	14.276	1.269	16.823	1.568	19.372	1.951	21.917	2.415	24.454	2.959	26.978	3.580	29.483	4.277	31.966	5.045	34.420	5.882	36.842	6.784	39.228	7.747	41.574	8.769	43.875	9.844	25	
23	13.745	1.232	16.293	1.557	18.841	1.971	21.383	2.474	23.913	3.062	26.425	3.732	28.914	4.482	31.374	5.307	33.799	6.204	36.185	7.167	38.526	8.194	40.820	9.277			23	25 (P)*
20	12.949	1.188	15.498	1.561	18.042	2.035	20.575	2.608	23.087	3.277	25.572	4.036	28.023	4.881	30.432	5.806	32.793	6.807	35.100	7.875							20	25 (H)**
15	11.623	1.170	14.166	1.661	16.689	2.283	19.179	3.027	21.623	3.886	24.009	4.849	26.325	5.906													15	20 (P)*
14	11.358	1.180	13.897	1.704	16.411	2.366	18.884	3.156	21.303	4.065	23.652	5.080															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 30 Degrees

$\Delta = 30°$

R_C	$L_S = 80$ metres		$L_S = 85$ metres		$L_S = 90$ metres		$L_S = 95$ metres		$L_S = 100$ metres		$L_S = 105$ metres		$L_S = 110$ metres		$L_S = 115$ metres		$L_S = 120$ metres		$L_S = 125$ metres		$L_S = 130$ metres		$L_S = 135$ metres		$L_S = 140$ metres		R_C	Speed km/h
metre	T_N	E_N	T_H	E_H	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_N	E_N	T_H	E_H	T_S	E_S	T_S	E_S	metre	
2500	709.901	88.302	712.404	88.316	714.908	88.331	717.412	88.347	719.917	88.364	722.421	88.381	724.926	88.400	727.431	88.419	729.936	88.439	732.441	88.461	734.947	88.483	737.452	88.505	739.958	88.529	2500	
2200	629.520	77.733	632.024	77.750	634.528	77.767	637.033	77.785	639.538	77.804	642.043	77.824	644.548	77.845	647.054	77.867	649.559	77.890	652.065	77.915	654.572	77.939	657.078	77.966	659.585	77.992	2200	
2000	575.933	70.691	578.438	70.709	580.942	70.728	583.447	70.748	585.953	70.768	588.458	70.791	590.964	70.814	593.470	70.838	595.977	70.864	598.483	70.890	600.990	70.917	603.497	70.946	606.004	70.975	2000	
1800	522.347	63.651	524.852	63.671	527.357	63.692	529.863	63.714	532.369	63.737	534.875	63.762	537.382	63.787	539.888	63.814	542.395	63.843	544.903	63.872	547.410	63.902	549.918	63.934	552.426	63.967	1800	
1500	441.970	53.099	444.476	53.122	446.983	53.148	449.489	53.174	451.996	53.202	454.503	53.232	457.011	53.263	459.519	53.295	462.027	53.329	464.536	53.364	467.045	53.401	469.554	53.438	472.064	53.478	1500	
1200	361.597	42.562	364.104	42.592	366.612	42.623	369.120	42.656	371.629	42.691	374.138	42.728	376.647	42.767	379.157	42.807	381.668	42.849	384.178	42.893	386.690	42.939	389.201	42.987	391.713	43.036	1200	
1000	308.018	35.552	310.527	35.588	313.036	35.626	315.546	35.666	318.056	35.708	320.567	35.752	323.078	35.798	325.590	35.847	328.103	35.897	330.615	35.950	333.129	36.003	335.642	36.063	338.156	36.122	1000	
900	281.231	32.056	283.740	32.095	286.251	32.137	288.762	32.181	291.273	32.228	293.785	32.277	296.297	32.329	298.810	32.382	301.324	32.439	303.838	32.497	306.352	32.559	308.867	32.622	311.383	32.688	900	
800	254.445	28.366	256.956	28.611	259.468	28.658	261.979	28.708	264.492	28.760	267.006	28.816	269.519	28.874	272.034	28.934	274.549	28.997	277.064	29.063	279.581	29.132	282.097	29.204	284.615	29.278	800	
700	227.662	25.088	230.174	25.139	232.687	25.193	235.201	25.250	237.715	25.310	240.230	25.373	242.746	25.439	245.262	25.508	247.779	25.581	250.297	25.656	252.815	25.735	255.334	25.816	257.854	25.901	700	
600	200.883	21.625	203.397	21.685	205.912	21.748	208.427	21.815	210.944	21.885	213.461	21.958	215.979	22.036	218.498	22.116	221.017	22.201	223.537	22.289	226.058	22.380	228.580	22.476	231.102	22.574	600	
500	175.109	18.190	176.626	18.261	179.143	18.337	181.662	18.417	184.181	18.500	186.701	18.589	189.222	18.682	191.744	18.779	194.267	18.880	196.791	18.985	199.315	19.095	201.840	19.209	204.366	19.328	500	
400	147.345	14.801	149.865	14.889	152.387	14.984	154.909	15.083	157.432	15.188	159.957	15.299	162.482	15.415	165.009	15.536	167.536	15.662	170.065	15.794	172.594	15.931	175.124	16.074	177.655	16.222	400	
360	136.644	13.466	139.166	13.565	141.689	13.670	144.214	13.780	146.739	13.897	149.266	14.020	151.794	14.148	154.323	14.283	156.852	14.423	159.383	14.570	161.915	14.722	164.447	14.881	166.980	15.045	360	100 (P)*
350	133.969	13.135	136.492	13.237	139.016	13.344	141.541	13.458	144.067	13.578	146.594	13.705	149.123	13.837	151.652	13.975	154.182	14.120	156.714	14.270	159.246	14.427	161.779	14.590	164.313	14.759	350	
300	120.599	11.503	123.125	11.621	125.652	11.747	128.181	11.880	130.710	12.019	133.241	12.167	135.773	12.321	138.306	12.482	140.840	12.650	143.375	12.826	145.911	13.009	148.448	13.199	150.986	13.396	300	
250	107.239	9.922	109.769	10.064	112.300	10.215	114.833	10.374	117.367	10.542	119.902	10.719	122.438	10.903	124.975	11.097	127.514	11.299	130.053	11.509	132.594	11.728	135.135	11.956	137.678	12.192	250	
230	101.898	9.313	104.430	9.467	106.964	9.631	109.498	9.804	112.034	9.986	114.571	10.177	117.110	10.378	119.649	10.588	122.190	10.808	124.731	11.036	127.274	11.274	129.817	11.521	132.361	11.777	230	80 (P)*
200	93.893	8.434	96.429	8.611	98.965	8.799	101.503	8.998	104.043	9.207	106.583	9.427	109.125	9.658	111.668	9.899	114.212	10.151	116.756	10.414	119.301	10.687	121.848	10.970	124.394	11.264	200	
170	85.897	7.618	88.436	7.826	90.977	8.047	93.519	8.281	96.062	8.527	98.606	8.785	101.152	9.056	103.698	9.339	106.245	9.635	108.792	9.943	111.340	10.263	113.888	10.596	116.437	10.940	170	
155	81.903	7.245	84.445	7.473	86.988	7.715	89.532	7.971	92.077	8.241	94.623	8.524	97.170	8.820	99.717	9.130	102.265	9.454	104.814	9.791	107.363	10.142	109.911	10.506	112.460	10.883	155	65 (P)*
125	73.927	6.610	76.473	6.893	79.020	7.192	81.568	7.508	84.116	7.841	86.665	8.190	89.214	8.556	91.763	8.939	94.311	9.338	96.860	9.754	99.407	10.186	101.954	10.634	104.499	11.098	125	
100	67.293	6.273	69.842	6.624	72.391	6.997	74.939	7.389	77.488	7.803	80.035	8.237	82.581	8.691	85.126	9.166	87.669	9.660	90.210	10.174	92.749	10.709	95.285	11.263	97.817	11.836	100	
90	64.642	6.221	67.191	6.610	69.739	7.023	72.286	7.458	74.832	7.915	77.377	8.395	79.919	8.898	82.459	9.422	84.996	9.968	87.529	10.536	90.059	11.126	92.585	11.737	95.107	12.369	90	50 (P)*
80	61.990	6.242	64.537	6.679	67.083	7.141	69.627	7.628	72.168	8.140	74.706	8.676	77.241	9.237	79.772	9.823	82.298	10.433	84.819	11.066	87.335	11.723	89.845	12.403	92.349	13.106	80	50 (H)**
70	59.334	6.368	61.877	6.863	64.417	7.388	66.953	7.940	69.484	8.521	72.011	9.128	74.532	9.764	77.046	10.425	79.554	11.114	82.054	11.828	84.546	12.569	87.030	13.335	89.504	14.125	70	
60	56.664	6.645	59.197	7.219	61.724	7.824	64.244	8.462	66.757	9.130	69.262	9.830	71.757	10.559	74.243	11.319	76.717	12.107	79.181	12.925	81.632	13.770	84.069	14.643	86.493	15.542	60	40 (P)*
55	55.317	6.866	57.861	7.487	60.357	8.143	62.864	8.833	65.362	9.556	67.849	10.311	70.324	11.098	72.787	11.917	75.236	12.766	77.671	13.645	80.090	14.553	82.493	15.489	84.879	16.453	55	
50	53.956	7.161	56.466	7.839	58.967	8.553	61.455	9.304	63.931	10.089	66.393	10.910	68.840	11.763	71.271	12.649	73.685	13.567	76.080	14.516	78.457	14.495	80.813	16.502	83.148	17.538	50	40 (H)**
45	52.571	7.552	55.061	8.297	57.538	9.081	59.999	9.902	62.444	10.762	64.870	11.657	67.277	12.587	69.663	13.551	72.027	14.547	74.368	15.575	76.684	16.632	78.975	17.719	81.239	18.833	45	35 (P)*
40	51.145	8.072	53.605	8.896	56.046	9.762	58.466	10.668	60.864	11.613	63.238	12.595	65.586	13.613	67.907	14.665	70.200	15.750	72.463	16.866							40	30 (H)**
35	49.647	8.765	52.060	9.685	54.446	10.649	56.803	11.654	59.130	12.699	61.425	13.781															35	
33	49.016	9.104	51.402	10.068	53.758	11.076	56.081	12.126	58.370	13.215																	33	30 (P)*
30	48.018	9.698	50.353	10.733	52.659	11.813																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 31 Degrees

Δ=31°

R_C	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_{cr}	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	700.812	94.360	703.313	94.363	705.814	94.367	708.315	94.372	710.816	94.378	713.318	94.384	715.820	94.392	718.322	94.400	720.825	94.409	723.327	94.419	725.830	94.429	728.333	94.441	730.837	94.454	2500	
2200	617.615	83.038	620.115	83.042	622.617	83.046	625.118	83.052	627.620	83.058	630.122	83.065	632.624	83.073	635.127	83.083	637.629	83.093	640.132	83.104	642.635	83.117	645.139	83.130	647.643	83.144	2200	
2000	562.150	75.490	564.651	75.494	567.152	75.499	569.654	75.505	572.156	75.512	574.658	75.520	577.160	75.529	579.663	75.539	582.166	75.551	584.669	75.563	587.173	75.577	589.677	75.591	592.181	75.607	2000	
1800	506.685	67.942	509.186	67.946	511.688	67.952	514.189	67.958	516.692	67.966	519.194	67.975	521.697	67.985	524.199	67.997	526.703	68.010	529.207	68.023	531.711	68.038	534.215	68.054	536.719	68.072	1800	
1500	423.488	56.621	425.990	56.625	428.491	56.632	430.993	56.640	433.496	56.649	435.999	56.660	438.502	56.672	441.005	56.686	443.510	56.701	446.014	56.718	448.519	56.736	451.023	56.755	453.529	56.776	1500	
1200	340.291	45.299	342.793	45.306	345.295	45.314	347.798	45.323	350.301	45.333	352.804	45.349	355.308	45.364	357.813	45.381	360.318	45.400	362.823	45.421	365.329	45.443	367.835	45.468	370.342	45.494	1200	
1000	284.827	37.752	287.329	37.760	289.832	37.770	292.335	37.782	294.838	37.796	297.343	37.812	299.847	37.830	302.353	37.851	304.859	37.873	307.365	37.898	309.872	37.925	312.379	37.954	314.888	37.986	1000	
900	257.095	33.979	259.597	33.988	262.100	33.999	264.603	34.012	267.107	34.027	269.612	34.045	272.117	34.066	274.623	34.088	277.130	34.114	279.637	34.141	282.145	34.171	284.653	34.204	287.162	34.239	900	
800	229.363	30.206	231.865	30.216	234.368	30.228	236.872	30.243	239.377	30.260	241.882	30.281	244.388	30.303	246.895	30.329	249.402	30.357	251.910	30.389	254.419	30.422	256.928	30.459	259.438	30.498	800	
700	201.631	26.434	204.134	26.445	206.637	26.458	209.142	26.475	211.647	26.496	214.153	26.519	216.660	26.545	219.167	26.574	221.676	26.606	224.185	26.642	226.694	26.681	229.205	26.723	231.716	26.767	700	100 (P)*
600	173.899	22.662	176.402	22.675	178.906	22.691	181.412	22.710	183.918	22.734	186.425	22.761	188.933	22.792	191.441	22.826	193.951	22.864	196.461	22.905	198.973	22.950	201.485	22.999	203.998	23.051	600	
500	146.167	18.891	148.671	18.906	151.176	18.925	153.682	18.949	156.190	18.977	158.698	19.010	161.207	19.046	163.718	19.087	166.229	19.133	168.742	19.183	171.255	19.237	173.770	19.295	176.285	19.358	500	
400	118.436	15.121	120.941	15.140	123.447	15.165	125.955	15.194	128.464	15.229	130.974	15.270	133.486	15.316	135.999	15.367	138.513	15.424	141.028	15.486	143.545	15.554	146.062	15.626	148.581	15.705	400	
360	107.344	13.615	109.849	13.635	112.356	13.682	114.865	13.696	117.375	13.775	119.886	13.779	122.399	13.831	124.913	13.887	127.428	13.951	129.945	14.020	132.463	14.094	134.983	14.176	137.504	14.263	360	
350	104.571	13.238	107.076	13.259	109.584	13.287	112.092	13.371	114.602	13.361	117.114	13.407	119.627	13.460	122.142	13.519	124.658	13.583	127.175	13.635	129.694	13.732	132.214	13.815	134.735	13.905	350	
300	90.706	11.355	93.212	11.381	95.721	11.413	98.231	11.452	100.743	11.499	103.256	11.553	105.771	11.615	108.288	11.683	110.806	11.759	113.326	11.841	115.847	11.932	118.370	12.029	120.894	12.133	300	80 (P)*
250	76.841	9.475	79.349	9.505	81.859	9.544	84.371	9.591	86.885	9.647	89.401	9.712	91.919	9.786	94.438	9.868	96.960	9.959	99.483	10.058	102.008	10.166	104.535	10.282	107.063	10.408	250	
230	71.296	8.723	73.804	8.756	76.315	8.798	78.828	8.850	81.343	8.911	83.860	8.982	86.379	9.061	88.900	9.151	91.423	9.249	93.948	9.357	96.475	9.475	99.004	9.601	101.534	9.737	230	
200	62.978	7.597	65.487	7.635	67.999	7.684	70.514	7.743	73.031	7.813	75.551	7.894	78.072	7.986	80.596	8.089	83.122	8.202	85.650	8.326	88.180	8.461	90.712	8.607	93.246	8.763	200	
170	54.660	6.473	57.171	6.518	59.685	6.575	62.202	6.645	64.722	6.728	67.245	6.823	69.770	6.931	72.297	7.052	74.827	7.185	77.358	7.331	79.892	7.489	82.428	7.661	84.966	7.844	170	65 (P)*
155	50.501	5.913	53.014	5.962	55.529	6.024	58.048	6.101	60.569	6.192	63.093	6.296	65.620	6.415	68.150	6.547	70.682	6.693	73.216	6.853	75.752	7.027	78.290	7.215	80.831	7.416	155	
125	42.185	4.796	44.700	4.856	47.219	4.934	49.742	5.029	52.267	5.141	54.796	5.271	57.328	5.417	59.863	5.581	62.400	5.762	64.940	5.961	67.482	6.176	70.026	6.408	72.572	6.657	125	
100	35.237	3.872	37.775	3.947	40.298	4.044	42.825	4.163	45.356	4.303	47.890	4.465	50.428	4.648	52.969	4.853	55.512	5.079	58.057	5.326	60.605	5.594	63.154	5.884	65.704	6.194	100	
90	32.486	3.505	35.006	3.589	37.531	3.697	40.061	3.829	42.594	3.985	45.131	4.164	47.672	3.368	50.215	4.595	52.761	4.845	55.309	5.120	57.858	5.417	60.409	5.738	62.961	6.083	90	50 (P)*
80	29.716	3.141	32.238	3.235	34.766	3.357	37.298	3.505	39.835	3.680	42.375	3.882	44.918	4.111	47.465	4.366	50.013	4.648	52.563	4.955	55.115	5.290	57.667	5.650	60.219	6.036	80	50 (H)**
70	26.947	2.781	29.472	2.889	32.002	3.028	34.538	3.197	37.078	3.397	39.622	3.627	42.168	3.888	44.718	4.179	47.268	4.500	49.820	4.851	52.373	5.232	54.925	5.642	57.476	6.081	70	
60	24.179	2.427	26.707	2.553	29.242	2.714	31.781	2.912	34.325	3.145	36.873	3.413	39.422	3.717	41.974	4.055	44.526	4.428	47.078	4.836	49.629	5.278	52.178	5.753	54.725	6.262	60	40 (P)*
55	22.795	2.253	25.326	2.390	27.862	2.566	30.404	2.782	32.950	3.035	35.500	3.328	38.051	3.658	40.603	4.027	43.155	4.433	45.706	4.876	48.255	5.356	50.800	5.873	53.342	6.425	55	
50	21.413	2.082	23.945	2.233	26.484	2.426	29.029	2.663	31.577	2.942	34.128	3.263	36.680	3.626	39.232	4.030	41.783	4.475	44.331	4.961	46.876	5.486	49.415	6.051	51.948	6.655	50	40 (H)**
45	20.030	1.914	22.566	2.082	25.108	2.297	27.654	2.560	30.205	2.869	32.757	3.225	35.309	3.627	37.860	4.074	40.407	4.567	42.950	5.103	45.488	5.683	48.017	6.306	50.537	6.971	45	35 (P)*
40	18.649	1.753	21.187	1.941	23.732	2.183	26.282	2.478	28.833	2.825	31.386	3.224	33.936	3.674	36.483	4.175	39.025	4.725	41.559	5.324	44.083	5.971	46.596	6.664	49.096	7.401	40	35 (H) 30 (P)*
35	17.269	1.599	19.811	1.814	22.359	2.090	24.910	2.426	27.462	2.821	30.013	3.275	32.559	3.786	35.098	4.354	37.627	4.977	40.144	5.654	42.647	6.383	45.133	7.163	47.599	7.992	35	
33	16.717	1.540	19.251	1.768	21.810	2.060	24.362	2.416	26.914	2.835	29.462	3.315	32.005	3.855	34.539	4.455	37.061	5.112	39.568	5.826	42.058	6.594	44.528	7.414	46.975	8.285	33	
30	15.891	1.456	18.436	1.707	20.987	2.028	23.539	2.418	26.089	2.877	28.634	3.402	31.169	3.993	33.691	4.647	36.198	5.364	38.685	6.140	41.150	6.973	43.589	7.861	45.999	8.802	30	30 (H)**
25	14.514	1.331	17.064	1.631	19.616	2.015	22.166	2.480	24.708	3.026	27.217	3.648	29.743	4.346	32.238	5.116	34.700	5.955	37.130	6.859	39.525	7.825	41.880	8.849	44.191	9.927	25	
23	13.965	1.289	16.515	1.615	19.067	2.031	21.614	2.595	24.149	3.124	26.667	3.796	29.163	4.548	31.630	5.375	34.063	6.273	36.458	7.239	38.809	8.268	41.112	9.354			23	25 (P)*
20	13.141	1.219	15.693	1.612	18.242	2.087	20.779	2.662	23.298	3.312	25.790	4.093	28.248	4.940	30.666	5.868	33.036	6.870	35.352	7.941							20	25 (H)**
15	11.770	1.209	14.317	1.701	16.846	2.324	19.343	3.070	21.794	3.931	24.189	4.896	26.514	5.956													15	20 (P)*
14	11.495	1.216	14.039	1.742	16.559	2.405	19.040	3.197	21.466	4.108	23.825	5.125															14	20 (H)**

*P - Plain & Rolling Terrian **H Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 31 Degrees

$\Delta = 31°$

R_1	$L_{s1}=80$ metres		$L_{s1}=85$ metres		$L_{s1}=90$ metres		$L_{s1}=95$ metres		$L_{s1}=100$ metres		$L_{s1}=105$ metres		$L_{s1}=110$ metres		$L_{s1}=115$ metres		$L_{s1}=120$ metres		$L_{s1}=125$ metres		$L_{s1}=130$ metres		$L_{s1}=135$ metres		$L_{s1}=140$ metres		R_C	Speed km/h
	T_1	L_2	T_1	E_2	T_1	E_2	T_1	E_2	T_1	E_2	T_1	E_2	T_1	E_2	T_1	E_2	T_1	E_2	T_1	E_2	T_1	E_2	T_1	E_2				
metre																									metre			
2500	733.340	94.467	735.844	94.481	738.348	94.497	740.852	94.513	743.356	94.530	745.861	94.547	748.366	94.566	750.871	94.585	753.376	94.605	755.882	94.627	758.387	94.649	760.893	94.672	763.400	94.696	2500	
2200	650.146	83.159	652.651	83.176	655.155	83.193	657.660	83.211	660.165	83.230	662.670	83.250	665.176	83.272	667.682	83.294	670.188	83.317	672.694	83.341	675.200	83.366	677.707	83.392	680.214	83.419	2200	
2000	594.685	75.624	597.190	75.642	599.695	75.660	602.200	75.680	604.705	75.701	607.211	75.724	609.717	75.747	612.224	75.771	614.730	75.797	617.237	75.823	619.744	75.851	622.251	75.879	624.759	75.909	2000	
1800	539.224	68.091	541.729	68.110	544.235	68.131	546.741	68.154	549.247	68.177	551.753	68.201	554.260	68.227	556.767	68.254	559.274	68.282	561.781	68.312	564.289	68.343	566.798	68.375	569.306	68.407	1800	
1500	456.035	56.798	458.541	56.822	461.048	56.847	463.554	56.874	466.062	56.902	468.569	56.932	471.077	56.963	473.585	56.995	476.094	57.029	478.603	57.064	481.113	57.101	483.622	57.139	486.132	57.179	1500	
1200	372.849	45.522	375.357	45.552	377.865	45.583	380.374	45.616	382.883	45.651	385.392	45.688	387.902	45.727	390.412	45.768	392.923	45.810	395.434	45.854	397.946	45.900	400.458	45.948	402.970	45.997	1200	
1000	317.396	38.019	319.903	38.055	322.413	38.093	324.925	38.133	327.436	38.175	329.947	38.219	332.458	38.266	334.971	38.314	337.484	38.365	339.997	38.418	342.510	38.473	345.025	38.531	347.539	38.590	1000	
900	289.671	34.276	292.181	34.315	294.692	34.357	297.203	34.402	299.715	34.449	302.228	34.498	304.740	34.550	307.254	34.604	309.768	34.660	312.282	34.719	314.798	34.780	317.313	34.844	319.829	34.910	900	
800	261.948	30.540	264.460	30.584	266.972	30.632	269.484	30.682	271.997	30.735	274.511	30.790	277.026	30.848	279.541	30.909	282.056	30.972	284.573	31.039	287.089	31.107	289.607	31.179	292.125	31.253	800	
700	234.228	26.815	236.741	26.866	239.255	26.920	241.769	26.977	244.284	27.038	246.799	27.101	249.315	27.167	251.832	27.237	254.350	27.309	256.868	27.385	259.387	27.463	261.907	27.545	264.427	27.630	700	
600	206.512	23.107	209.027	23.166	211.542	23.229	214.058	23.296	216.576	23.366	219.093	23.440	221.612	23.517	224.132	23.598	226.652	23.683	229.173	23.771	231.695	23.863	234.217	23.958	236.740	24.057	600	
500	178.801	19.425	181.319	19.496	183.837	19.572	186.356	19.652	188.877	19.736	191.398	19.824	193.919	19.917	196.442	20.014	198.966	20.116	201.490	20.222	204.016	20.332	206.542	20.447	209.069	20.565	500	
400	151.101	15.789	153.622	15.878	156.145	15.972	158.668	16.072	161.192	16.177	163.718	16.288	166.244	16.404	168.772	16.526	171.300	16.652	173.830	16.785	176.360	16.922	178.892	17.065	181.424	17.214	400	
360	140.026	14.356	142.549	14.455	145.073	14.560	147.599	14.671	150.125	14.788	152.653	14.911	155.182	15.040	157.712	15.174	160.243	15.315	162.775	15.462	165.308	15.615	167.842	15.773	170.377	15.938	360	100 (P)*
350	137.257	14.000	139.781	14.102	142.306	14.210	144.832	14.324	147.359	14.445	149.888	14.571	152.417	14.703	154.948	14.842	157.480	14.987	160.012	15.138	162.546	15.295	165.081	15.458	167.616	15.628	350	
300	123.420	12.245	125.947	12.363	128.475	12.489	131.005	12.623	133.536	12.763	136.068	12.910	138.601	13.065	141.136	13.227	143.671	13.395	146.208	13.571	148.746	13.754	151.284	13.945	153.824	14.142	300	
250	109.593	10.542	112.124	10.684	114.656	10.835	117.191	10.995	119.726	11.163	122.263	11.340	124.801	11.525	127.340	11.719	129.880	11.921	132.422	12.132	134.964	12.352	137.508	12.580	140.052	12.816	250	
230	104.065	9.883	106.599	10.037	109.134	10.202	111.670	10.375	114.207	10.558	116.746	10.750	119.287	10.951	121.828	11.162	124.370	11.381	126.914	11.611	129.459	11.849	132.004	12.097	134.550	12.353	230	80 (P)*
200	95.781	8.930	98.318	9.108	100.856	9.297	103.396	9.496	105.937	9.706	108.480	9.926	111.024	10.157	113.569	10.399	116.115	10.652	118.662	10.915	121.209	11.188	123.758	11.473	126.307	11.767	200	
170	87.506	8.041	90.047	8.250	92.589	8.471	95.134	8.705	97.679	8.952	100.226	9.211	102.773	9.482	105.322	9.766	107.871	10.063	110.422	10.371	112.972	10.692	115.524	11.026	118.076	11.371	170	
155	83.373	7.631	85.916	7.860	88.461	8.103	91.008	8.359	93.555	8.629	96.104	8.913	98.653	9.210	101.204	9.521	103.755	9.846	106.306	10.184	108.858	10.535	111.410	10.900	113.963	11.278	155	65 (P)*
125	75.119	6.924	77.667	7.207	80.217	7.507	82.768	7.824	85.319	8.157	87.871	8.508	90.423	8.875	92.976	9.258	95.528	9.658	98.080	10.075	100.631	10.508	103.182	10.957	105.732	11.422	125	
100	68.255	6.326	70.807	6.578	73.360	7.251	75.912	7.645	78.464	8.060	81.015	8.495	83.566	8.950	86.115	9.426	88.662	9.921	91.208	10.437	93.751	10.972	96.292	11.528	98.830	12.102	100	
90	65.513	6.450	68.065	6.840	70.618	7.254	73.169	7.690	75.719	8.149	78.268	8.630	80.815	9.133	83.359	9.659	85.901	10.206	88.440	10.776	90.975	11.367	93.507	11.979	96.034	12.613	90	50 (P)*
80	62.771	6.448	65.322	6.885	67.872	7.348	70.420	7.836	72.966	8.350	75.509	8.888	78.049	9.450	80.585	10.037	83.117	10.648	85.644	11.283	88.166	11.941	90.682	12.623	93.192	13.328	80	50 (H)**
70	60.025	6.560	62.573	7.047	65.117	7.572	67.658	8.126	70.195	8.708	72.727	9.317	75.254	9.954	77.775	10.617	80.289	11.307	82.795	12.093	85.294	12.766	87.784	13.533	90.265	14.326	70	
60	57.267	6.804	59.805	7.379	62.338	7.986	64.864	8.625	67.383	9.295	69.894	9.996	72.396	10.727	74.888	11.489	77.370	12.279	79.841	13.098	82.300	13.946	84.745	14.821	87.177	15.722	60	40 (P)*
55	55.877	7.013	58.407	7.636	60.929	8.294	63.442	8.985	65.947	9.710	68.440	10.467	70.923	11.256	73.393	12.076	75.850	12.927	78.292	13.808	80.720	14.719	83.132	15.657	85.526	16.623	55	
50	54.474	7.297	56.990	7.976	59.497	8.693	61.992	9.445	64.475	10.233	66.945	11.055	69.400	11.910	71.838	12.799	74.261	13.719	76.665	14.670	79.050	15.651	81.415	16.661	83.759	17.699	50	40 (H)**
45	53.047	7.677	55.544	8.424	58.028	9.209	60.496	10.033	62.949	10.894	65.383	11.792	67.798	12.724	70.193	13.690	72.566	14.689	74.916	15.719	77.242	16.779	79.543	17.868	81.817	18.985	45	35 (P)*
40	51.580	8.186	54.048	9.012	56.497	9.880	58.925	10.789	61.332	11.736	63.714	12.720	66.072	13.741	68.402	14.796	70.705	15.883	72.978	17.001							40	30 (H)**
35	50.044	8.869	52.465	9.791	54.859	10.757	57.226	11.765	59.562	12.813	61.867	13.898															35	
33	49.398	9.205	51.792	10.171	54.157	11.181	56.490	12.233	58.788	13.325																	33	70 (P)*
30	48.377	9.793	50.721	10.830	53.029	11.912																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P Plain & Rolling Terrain **H Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 32 Degrees

△=32°

R_c	L_s = 15 metres		L_s = 20 metres		L_s = 25 metres		L_s = 30 metres		L_s = 35 metres		L_s = 40 metres		L_s = 45 metres		L_s = 50 metres		L_s = 55 metres		L_s = 60 metres		L_s = 65 metres		L_s = 70 metres		L_s = 75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	724.364	100.752	726.865	100.755	729.366	100.760	731.867	100.764	734.369	100.770	736.870	100.776	739.373	100.784	741.875	100.792	744.377	100.801	746.880	100.811	749.383	100.822	751.886	100.834	754.389	100.846	2500	
2400	638.341	88.663	640.842	88.667	643.343	88.671	645.844	88.677	648.346	88.683	650.848	88.690	653.350	88.698	655.853	88.708	658.355	88.719	660.859	88.729	663.362	88.742	665.866	88.755	668.370	88.770	2200	
2000	580.992	80.604	583.493	80.607	585.994	80.612	588.496	80.618	590.998	80.625	593.500	80.634	596.002	80.643	598.505	80.653	601.008	80.664	603.511	80.677	606.015	80.690	608.519	80.703	611.023	80.721	2000	
1800	523.643	72.544	526.144	72.549	528.645	72.554	531.147	72.561	533.649	72.568	536.152	72.578	538.655	72.588	541.157	72.599	543.661	72.612	546.165	72.625	548.669	72.641	551.173	72.657	553.678	72.674	1800	
1500	437.620	60.456	440.121	60.461	442.623	60.467	445.125	60.475	447.627	60.484	450.130	60.495	452.634	60.508	455.137	60.521	457.642	60.536	460.146	60.553	462.651	60.571	465.156	60.591	467.662	60.512	1500	
1200	351.596	48.367	354.098	48.374	356.600	48.382	359.103	48.392	361.606	48.404	364.110	48.417	366.614	48.432	369.119	48.450	371.624	48.469	374.129	48.489	376.635	48.512	379.142	48.536	381.649	48.563	1200	
1000	294.248	40.309	296.750	40.317	299.253	40.327	301.756	40.339	304.260	40.353	306.764	40.369	309.269	40.387	311.774	40.408	314.281	40.430	316.787	40.455	319.294	40.482	321.802	40.512	324.311	40.543	1000	
900	265.574	36.280	268.076	36.289	270.579	36.300	273.082	36.313	275.587	36.328	278.092	36.346	280.597	36.367	283.103	36.390	285.610	36.415	288.117	36.443	290.625	36.473	293.134	36.505	295.643	36.541	900	
800	236.899	32.252	239.402	32.261	241.905	32.273	244.409	32.288	246.914	32.306	249.420	32.326	251.926	32.349	254.433	32.375	256.940	32.403	259.448	32.435	261.958	32.468	264.467	32.505	266.977	32.544	800	
700	208.225	28.224	210.728	28.234	213.232	28.248	215.737	28.265	218.242	28.286	220.748	28.309	223.255	28.335	225.763	28.364	228.272	28.397	230.781	28.433	233.291	28.471	235.802	28.513	238.314	28.558	700	100 (P)*
600	179.552	24.196	182.055	24.208	184.559	24.225	187.065	24.245	189.571	24.268	192.078	24.295	194.586	24.326	197.095	24.360	199.605	24.398	202.116	24.440	204.628	24.485	207.141	24.534	209.654	24.586	600	
500	150.878	20.169	153.382	20.185	155.887	20.204	158.394	20.228	160.901	20.256	163.410	20.288	165.919	20.325	168.430	20.366	170.942	20.412	173.455	20.462	175.969	20.516	178.484	20.574	181.000	20.637	500	
400	122.205	16.144	124.710	16.163	127.216	16.187	129.724	16.217	132.234	16.253	134.744	16.293	137.256	16.339	139.770	16.391	142.286	16.448	144.800	16.510	147.317	16.577	149.835	16.651	152.355	16.729	400	
360	110.736	14.535	113.241	14.556	115.748	14.583	118.257	14.616	120.768	14.655	123.279	14.700	125.793	14.752	128.307	14.809	130.823	14.872	133.341	14.941	135.860	15.016	138.380	15.097	140.901	15.185	360	
350	107.868	14.133	110.374	14.154	112.882	14.182	115.391	14.216	117.901	14.256	120.413	14.303	122.927	14.355	125.442	14.414	127.958	14.479	130.476	14.551	132.996	14.628	135.516	14.711	138.038	14.801	350	
300	93.532	12.122	96.039	12.148	98.548	12.180	101.058	12.220	103.570	12.267	106.084	12.321	108.600	12.382	111.117	12.451	113.636	12.527	116.157	12.610	118.679	12.700	121.2	12.797	123.728	12.902	300	80 (P)*
250	79.197	10.114	81.705	10.144	84.215	10.183	86.727	10.231	89.242	10.287	91.758	10.352	94.277	10.426	96.797	10.508	99.320	10.599	101.844	10.699	104.370	10.807	106.897	10.924	109.427	11.049	250	
230	73.463	9.311	75.972	9.344	78.483	9.387	80.996	9.438	83.512	9.500	86.029	9.570	88.549	9.650	91.071	9.740	93.595	9.839	96.121	9.947	98.649	10.065	101.179	10.192	103.710	10.228	230	
200	64.862	8.109	67.372	8.147	69.885	8.195	72.400	8.255	74.918	8.325	77.438	8.407	79.960	8.499	82.485	8.601	85.012	8.715	87.541	8.839	90.073	8.975	92.606	9.121	95.141	9.277	200	
170	56.262	6.908	58.774	6.953	61.288	7.010	63.806	7.080	66.327	7.163	68.850	7.259	71.376	7.367	73.904	7.488	76.435	7.621	78.968	7.768	81.504	7.927	84.041	8.098	86.581	8.283	170	65 (P)*
155	51.962	6.309	54.475	6.358	56.991	6.421	59.510	6.498	62.032	6.589	64.558	6.694	67.086	6.812	69.616	6.945	72.150	7.091	74.685	7.252	77.223	7.426	79.763	7.614	82.305	7.816	155	
125	43.368	5.105	45.879	5.176	48.399	5.254	50.922	5.349	53.449	5.462	55.979	5.592	58.512	5.739	61.048	5.903	63.587	6.085	66.129	6.283	68.673	6.499	71.219	6.732	73.767	6.982	125	
100	36.200	4.127	38.719	4.203	41.243	4.301	43.771	4.420	46.303	4.560	48.839	4.722	51.378	4.906	53.921	5.111	56.466	5.338	59.013	5.585	61.563	5.854	64.115	6.145	66.668	6.456	100	
90	31.335	3.735	33.856	3.820	36.382	3.928	38.913	4.060	43.447	4.216	45.985	4.396	48.528	4.600	51.074	4.828	53.622	5.079	56.172	5.354	58.725	5.652	61.278	5.974	63.833	6.319	90	50 (P)*
80	30.471	3.346	32.994	3.441	35.523	3.562	38.056	3.711	40.594	3.887	43.136	4.089	45.682	4.318	48.231	4.574	50.783	4.856	53.334	5.165	55.889	5.500	58.446	5.861	61.006	6.248	80	50 (H)**
70	27.608	2.950	30.134	3.068	32.665	3.208	35.201	3.377	37.744	3.578	40.290	3.809	42.839	4.070	45.391	4.362	47.945	4.684	50.500	5.036	53.056	5.417	55.611	5.828	58.167	6.269	70	
60	24.746	2.580	27.275	2.707	29.811	2.869	32.352	3.067	34.898	3.300	37.448	3.569	40.001	3.874	42.555	4.213	45.111	4.587	47.667	4.996	50.222	5.438	52.775	5.915	55.326	6.425	60	40 (P)*
55	23.315	2.394	25.847	2.531	28.385	2.708	30.929	2.924	33.477	3.178	36.029	3.472	38.583	3.803	41.139	4.172	43.695	4.579	46.250	5.024	48.803	5.505	51.353	6.023	53.899	6.577	55	
50	21.885	2.210	24.419	2.361	26.960	2.556	29.507	2.793	32.057	3.072	34.611	3.394	37.167	3.758	39.722	4.163	42.277	4.609	44.830	5.096	47.379	5.623	49.924	6.189	52.462	6.795	50	40 (H)**
45	20.456	2.030	22.993	2.198	25.537	2.414	28.086	2.677	30.639	2.987	33.194	3.344	35.750	3.747	38.305	4.195	40.857	4.689	43.405	5.227	45.948	5.808	48.483	6.433	51.009	7.099	45	35 (P)*
40	19.028	1.855	21.568	2.044	24.115	2.287	26.667	2.582	29.222	2.930	31.778	3.330	34.333	3.782	36.894	4.284	39.451	4.835	41.970	5.436	44.500	6.084	47.020	6.779	49.526	7.520	40	35 (H) 30 (P)*
35	17.601	1.689	20.145	1.904	22.695	2.181	25.250	2.518	27.806	2.914	30.360	3.369	32.911	3.882	35.455	4.451	37.999	5.075	40.513	5.754	43.023	6.485	45.515	7.267	47.989	8.098	35	
33	17.021	1.625	19.576	1.854	22.128	2.147	24.683	2.503	27.239	2.923	29.792	3.404	32.339	3.946	34.879	4.547	37.407	5.206	39.920	5.921	42.417	6.691	44.895	7.514	47.350	8.387	33	
30	16.176	1.533	18.724	1.785	21.278	2.106	23.833	2.498	26.388	2.958	28.932	3.484	31.472	4.077	34.006	4.733	36.529	5.451	39.013	6.229	41.485	7.064	43.932	7.954	46.351	8.898	30	30 (H)**
25	14.753	1.396	17.306	1.697	19.861	2.081	22.415	2.548	24.962	3.095	27.497	3.719	30.015	4.419	32.515	5.190	34.981	6.031	37.419	6.938	39.823	7.906	42.187	8.933	44.508	10.013	25	
23	14.185	1.349	16.739	1.676	19.294	2.092	21.845	2.598	24.386	3.188	26.911	3.862	29.413	4.615	31.887	5.445	34.329	6.345	36.732	7.314	39.093	8.345	41.406	9.434			23	25 (P)*
20	13.334	1.291	15.889	1.665	18.442	2.142	20.985	2.718	23.510	3.389	26.009	4.152	28.475	5.002	30.901	5.932	33.280	6.937	35.606	8.010							20	25 (H)**
15	11.917	1.249	14.468	1.742	17.003	2.366	19.507	3.114	21.966	3.977	24.369	4.945	26.705	6.008													15	20 (P)*
14	11.633	1.254	14.182	1.780	16.708	2.445	19.196	3.239	21.631	4.152	23.999	5.172															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 32 Degrees

△=32°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	756.893	100.860	759.397	100.874	761.901	100.889	764.406	100.905	766.910	100.922	769.415	100.940	771.920	100.958	774.425	100.978	776.930	100.998	779.436	101.020	781.942	101.042	784.448	101.064	786.955	101.088	2500	
2200	670.874	88.785	670.378	88.801	675.883	88.818	678.387	88.836	680.893	88.856	683.398	88.876	685.904	88.897	688.410	88.919	690.916	88.942	693.422	88.967	695.929	88.992	698.436	89.018	700.943	89.045	2200	
2000	613.528	80.738	616.033	80.756	618.538	80.774	621.043	80.794	623.549	80.815	626.055	80.838	628.561	80.861	631.068	80.885	633.575	80.911	636.082	80.938	638.589	80.965	641.097	80.994	643.604	81.023	2000	
1800	556.183	72.693	558.688	72.713	561.194	72.734	563.700	72.756	566.206	72.780	568.713	72.804	571.220	72.830	573.727	72.857	576.235	72.886	578.742	72.915	581.250	72.946	583.759	72.978	586.268	73.011	1800	
1500	470.168	60.634	472.674	60.658	475.181	60.683	477.688	60.710	480.195	60.738	482.703	60.768	485.212	60.799	487.720	60.831	490.229	60.865	492.739	60.901	495.248	60.938	497.758	60.976	500.269	61.015	1500	
1200	384.156	48.590	386.664	48.620	389.173	48.652	391.682	48.685	394.191	48.720	396.700	48.758	399.211	48.796	401.721	48.833	404.233	48.879	406.744	48.924	409.256	48.970	411.769	49.018	414.281	49.067	1200	
1000	326.819	40.577	329.329	40.613	331.839	40.650	334.349	40.690	336.861	40.733	339.372	40.777	341.884	40.824	344.397	40.873	346.910	40.923	349.424	40.977	351.938	41.032	354.453	41.089	356.968	41.149	1000	
900	298.153	36.578	300.663	36.617	303.175	36.660	305.686	36.704	308.198	36.751	310.711	36.800	313.224	36.852	315.738	36.906	318.253	36.963	320.768	37.022	323.284	37.083	325.800	37.147	328.317	37.213	900	
800	269.488	32.586	272.000	32.631	274.512	32.678	277.025	32.729	279.539	32.781	282.053	32.837	284.568	32.895	287.084	32.956	289.600	33.020	292.117	33.086	294.634	33.155	297.152	33.227	299.671	33.301	800	
700	240.826	28.606	243.340	28.657	245.854	28.711	248.368	28.768	250.884	28.829	253.400	28.892	255.917	28.958	258.434	29.028	260.953	29.101	263.472	29.177	265.991	29.256	268.512	29.338	271.033	29.423	700	
600	212.169	24.642	214.684	24.702	217.200	24.765	219.717	24.832	222.235	24.902	224.753	24.976	227.273	25.054	229.793	25.135	232.314	25.220	234.836	25.308	237.358	25.400	239.881	25.496	242.405	25.595	600	
500	183.517	20.704	186.035	20.776	188.554	20.852	191.074	20.932	193.595	21.016	196.117	21.105	198.639	21.198	201.163	21.296	203.688	21.397	206.213	21.503	208.740	21.614	211.267	21.729	213.795	21.848	500	
400	154.876	16.813	157.398	16.902	159.921	16.997	162.445	17.097	164.971	17.203	167.497	17.314	170.025	17.430	172.553	17.552	175.083	17.679	177.614	17.812	180.145	17.949	182.678	18.093	185.211	18.241	400	
360	143.424	15.278	145.948	15.377	148.474	15.583	151.000	15.594	153.528	15.711	156.057	15.834	158.587	15.964	161.118	16.099	163.650	16.240	166.183	16.387	168.718	16.540	171.253	16.699	173.790	16.865	360	100 (P)*
350	140.562	14.897	143.086	14.999	145.612	15.107	148.140	15.222	150.668	15.343	153.198	15.469	155.728	15.602	158.260	15.741	160.793	15.886	163.327	16.038	165.862	16.195	168.398	16.359	170.936	16.529	350	
300	126.255	13.014	128.783	13.133	131.312	13.259	133.843	13.393	136.375	13.533	138.909	13.681	141.443	13.836	143.979	13.998	146.516	14.167	149.055	14.344	151.594	14.528	154.134	14.718	156.676	14.916	300	
250	111.950	11.184	114.490	11.326	117.024	11.478	119.560	11.638	122.097	11.806	124.635	11.983	127.175	12.169	129.716	12.364	132.258	12.566	134.801	12.778	137.346	12.998	139.891	13.227	142.438	13.464	250	
230	106.243	10.474	108.778	10.629	111.314	10.793	113.852	10.967	116.391	11.150	118.932	11.343	121.474	11.545	124.017	11.756	126.562	11.976	129.107	12.206	131.654	12.445	134.202	12.693	136.751	12.950	230	80 (P)*
200	97.678	9.445	100.216	9.623	102.756	9.812	105.298	10.012	107.841	10.222	110.386	10.443	112.932	10.675	115.479	10.918	118.027	11.171	120.576	11.434	123.127	11.709	125.678	11.994	128.230	12.289	200	
170	89.122	8.480	91.665	8.689	94.210	8.911	96.756	9.146	99.303	9.393	101.852	9.652	104.403	9.925	106.954	10.209	109.506	10.506	112.059	10.816	114.613	11.138	117.167	11.472	119.722	11.818	170	
155	84.849	8.032	87.395	8.261	89.942	8.505	92.491	8.762	95.041	9.033	97.592	9.317	100.144	9.615	102.697	9.927	105.251	10.252	107.806	10.591	110.361	10.943	112.916	11.309	115.472	11.688	155	65 (P)*
125	76.316	7.249	78.868	7.533	81.420	7.833	83.974	8.151	86.528	8.485	89.083	8.837	91.639	9.204	94.195	9.589	96.750	9.990	99.306	10.408	101.861	10.842	104.416	11.292	106.970	11.758	125	
100	69.222	6.788	71.778	7.142	74.333	7.516	76.889	7.911	79.445	8.326	82.000	8.762	84.555	9.218	87.108	9.695	89.660	10.192	92.210	10.709	94.759	11.246	97.305	11.802	99.848	12.379	100	
90	66.389	6.688	68.945	7.079	71.508	7.493	74.056	7.931	76.610	8.390	79.163	8.873	81.714	9.377	84.264	9.904	86.811	10.453	89.355	11.024	91.895	11.616	94.432	12.230	96.965	12.865	90	50 (P)
80	63.556	6.661	66.111	7.099	68.665	7.563	71.218	8.053	73.768	8.567	76.316	9.107	78.861	9.670	81.403	10.259	83.940	10.871	86.473	11.508	89.001	12.168	91.523	12.851	94.039	13.558	80	50 (H)**
70	60.720	6.738	63.272	7.236	65.822	7.763	68.368	8.318	70.910	8.902	73.447	9.512	75.980	10.151	78.507	10.816	81.027	11.507	83.540	12.225	86.045	12.969	88.543	13.739	91.031	14.533	70	
60	57.874	6.969	60.417	7.565	62.955	8.153	65.487	8.794	68.012	9.466	70.529	10.168	73.038	10.902	75.537	11.665	78.027	12.457	80.505	13.278	82.971	14.128	85.424	15.005	87.865	15.909	60	40 (P)*
55	56.440	7.166	58.975	7.791	61.503	8.450	64.023	9.143	66.534	9.869	69.035	10.628	71.524	11.419	74.002	12.242	76.466	13.093	78.917	13.978	81.353	14.890	83.773	15.831	86.177	16.800	55	
50	54.994	7.438	57.517	8.119	60.030	8.837	62.532	9.591	65.022	10.381	67.499	11.205	69.962	12.063	72.409	12.953	74.839	13.876	77.252	14.829	79.646	15.813	82.020	16.825	84.374	17.865	50	40 (H)**
45	53.525	7.807	56.029	8.555	58.520	9.343	60.996	10.169	63.456	11.032	65.899	11.932	68.322	12.866	70.726	12.835	73.108	14.836	75.467	15.869	77.803	16.931	80.114	18.023	82.398	19.143	45	35 (P)*
40	52.018	8.305	54.493	9.133	56.950	10.003	59.386	10.914	61.801	11.863	64.193	12.850	66.560	13.873	68.900	14.931	71.212	16.021	73.495	17.142							40	30 (H)**
35	50.442	8.977	52.871	9.902	55.275	10.870	57.650	11.880	59.996	12.930	62.311	14.018															35	
33	49.781	9.309	52.184	10.277	54.558	11.290	56.901	12.345	59.209	13.439																	33	30 (P)*
30	48.739	9.891	51.092	10.931	53.409	12.015																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H : Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 33 Degrees

$\Delta = 33°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h		
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
metre																														
2500	748.034	107.376	750.535	107.379	753.036	107.383	755.537	107.387	758.039	107.393	760.541	107.400	763.043	107.407	765.545	107.415	768.048	107.425	770.551	107.434	773.054	107.445	775.557	107.457	778.061	107.469	2500			
2200	659.170	94.491	661.671	94.495	664.173	94.500	666.674	94.505	669.176	94.511	671.678	94.519	674.180	94.527	676.683	94.537	679.186	94.547	681.689	94.558	684.193	94.571	686.696	94.584	689.200	94.598	2200			
2000	599.928	85.902	602.429	85.906	604.930	85.911	607.432	85.917	609.934	85.924	612.436	85.932	614.939	85.941	617.442	85.952	619.945	85.963	622.448	85.976	624.952	85.989	627.456	86.004	629.961	86.020	2000			
1800	540.685	77.313	543.187	77.317	545.688	77.323	548.190	77.329	550.692	77.337	553.195	77.346	555.698	77.357	558.201	77.368	560.704	77.381	563.208	77.395	565.713	77.410	568.217	77.426	570.722	77.443	1800			
1500	451.822	64.430	454.323	64.435	456.825	64.441	459.327	64.449	461.830	64.458	464.333	64.469	466.836	64.482	469.340	64.495	471.844	64.511	474.349	64.528	476.854	64.546	479.359	64.565	481.865	64.586	1500			
1200	362.958	51.547	365.460	51.553	367.962	51.561	370.465	51.571	372.969	51.583	375.472	51.596	377.976	51.612	380.481	51.629	382.987	51.648	385.492	51.669	387.999	51.691	390.505	51.716	393.012	51.742	1200			
1000	303.716	42.958	306.218	42.966	308.721	42.976	311.224	42.988	313.728	43.002	316.233	43.018	318.738	43.037	321.244	43.057	323.750	43.080	326.257	43.105	328.764	43.132	331.272	43.162	333.781	43.193	1000			
900	274.095	38.665	276.597	38.673	279.101	38.684	281.604	38.698	284.108	38.713	286.614	38.731	289.119	38.752	291.625	38.775	294.133	38.800	296.640	38.828	299.148	38.858	301.657	38.890	304.167	38.926	900			
800	244.474	34.371	246.977	34.381	249.480	34.393	251.984	34.408	254.489	34.426	256.995	34.446	259.501	34.469	262.008	34.495	264.516	34.523	267.025	34.554	269.534	34.588	272.044	34.625	274.555	34.665	800			
700	214.853	30.078	217.356	30.089	219.860	30.103	222.365	30.120	224.870	30.140	227.377	30.163	229.884	30.190	232.392	30.219	234.901	30.252	237.411	30.288	239.921	30.326	242.433	30.368	244.945	30.413	700	100 (P)*		
600	185.233	25.786	187.736	25.798	190.241	25.814	192.746	25.834	195.253	25.858	197.760	25.885	200.269	25.916	202.778	25.950	205.288	25.988	207.799	26.030	210.312	26.075	212.825	26.124	215.339	26.177	600			
500	155.612	21.494	158.116	21.509	160.622	21.529	163.128	21.552	165.636	21.581	168.145	21.613	170.655	21.650	173.166	21.692	175.678	21.737	178.192	21.787	180.706	21.842	183.222	21.900	185.738	21.963	500			
400	125.992	17.204	128.497	17.223	131.004	17.248	133.512	17.277	136.022	17.313	138.533	17.354	141.045	17.399	143.559	17.451	146.074	17.508	148.591	17.571	151.108	17.638	153.628	17.712	156.148	17.790	400			
360	114.144	15.489	116.650	15.510	119.158	15.537	121.667	15.570	124.177	15.609	126.690	15.655	129.203	15.706	131.718	15.763	134.235	15.827	136.753	15.896	139.273	15.971	141.794	16.053	144.316	16.140	360			
350	111.182	15.060	113.688	15.082	116.196	15.110	118.705	15.144	121.216	15.184	123.729	15.231	126.243	15.283	128.759	15.343	131.276	15.408	133.794	15.479	136.314	15.557	138.836	15.640	141.359	15.730	350			
300	96.373	12.917	98.880	12.943	101.389	12.975	103.900	13.015	106.412	13.062	108.927	13.116	111.443	13.178	113.961	13.247	116.481	13.323	119.002	13.406	121.525	13.497	124.050	13.594	126.576	13.699	300	80 (P)*		
250	81.564	10.776	84.073	10.807	86.583	10.846	89.096	10.894	91.611	10.950	94.128	11.015	96.647	11.089	99.168	11.172	101.691	11.263	104.217	11.363	106.743	11.471	109.272	11.588	111.803	11.714	250			
230	75.641	9.921	78.150	9.954	80.661	9.996	83.173	10.048	85.691	10.110	88.210	10.180	90.730	10.261	93.253	10.350	95.778	10.449	98.305	10.558	100.834	10.676	103.365	10.803	105.897	10.940	230			
200	66.756	8.639	69.266	8.677	71.780	8.726	74.295	8.785	76.814	8.856	79.335	8.937	81.858	9.030	84.384	9.133	86.912	9.247	89.442	9.371	91.975	9.507	94.509	9.653	97.045	9.810	200			
170	57.872	7.359	60.384	7.401	62.899	7.461	65.418	7.531	67.939	7.614	70.463	7.710	72.990	7.819	75.520	7.940	78.052	8.074	80.586	8.221	83.123	8.380	85.662	8.552	88.203	8.737	170	65 (P)*		
155	53.430	6.720	55.944	6.769	58.460	6.832	60.980	6.909	63.503	7.000	66.029	7.105	68.558	7.223	71.090	7.357	73.625	7.504	76.162	7.665	78.701	7.840	81.243	8.028	83.787	8.221	155			
125	44.548	5.447	47.064	5.508	49.584	5.586	52.108	5.681	54.636	5.794	57.167	5.924	59.702	6.072	62.240	6.236	64.781	6.418	67.324	6.618	69.870	6.834	72.418	7.067	74.968	7.318	125			
100	35.648	4.393	38.167	4.469	40.687	4.566	43.211	4.686	45.735	4.827	48.262	4.989	50.792	5.173	53.325	5.379	55.861	5.606	58.400	5.854	60.942	6.124	63.487	6.415	66.035	6.727	100			
90	32.188	3.974	34.710	4.058	37.237	4.167	39.769	4.300	42.305	4.456	44.845	4.637	47.389	4.841	49.937	5.069	52.489	5.321	55.045	5.597	57.606	5.896	60.171	6.219	62.740	6.565	90	30 (P)*		
80	28.727	3.546	31.250	3.558	33.754	3.653	36.282	3.775	38.818	3.924	41.358	4.100	43.902	4.303	46.449	4.533	49.000	4.789	51.554	5.072	54.110	5.382	56.667	5.717	59.226	6.079	61.785	6.468	80	30 (H)**
70	25.272	3.146	27.799	3.255	30.299	3.255	33.332	3.394	35.870	3.564	38.411	3.765	40.962	3.997	43.515	4.259	46.068	4.551	48.624	4.874	51.183	5.227	53.742	5.609	56.302	6.021	58.861	6.463	70	
60	23.315	2.740	25.820	2.866	28.330	3.029	30.843	3.227	33.356	3.461	35.875	3.731	38.027	4.036	40.582	4.376	43.140	4.751	45.699	5.161	48.258	5.605	50.818	6.083	53.375	6.595	55.931	6.595	60	40 (P)*
55	21.838	2.540	24.340	2.678	26.850	2.855	29.361	3.071	31.876	3.327	34.007	3.627	36.561	3.620	39.118	3.953	41.677	4.323	44.237	4.731	46.796	5.177	49.353	5.659	51.908	6.178	54.460	6.734	55	
50	22.361	3.343	24.696	2.495	27.239	2.684	29.987	2.927	32.541	3.207	35.097	3.530	37.656	3.895	40.215	4.301	42.774	4.748	45.332	5.236	47.886	5.765	50.435	6.332	52.979	6.939	50	40 (H)**		
45	20.884	2.150	23.423	2.318	25.968	2.535	28.520	2.798	31.076	3.109	33.634	3.467	36.194	3.871	38.757	4.320	41.369	4.815	43.862	5.335	46.410	5.948	48.951	6.564	51.483	7.232	45	35 (P)*		
40	19.409	1.962	21.951	2.152	24.500	2.395	27.055	2.691	29.613	3.040	32.172	3.441	34.731	3.893	37.292	4.396	39.854	4.949	42.388	5.551	44.920	6.201	47.445	6.898	49.938	7.641	40	35 (H) 30 (P)*		
38	17.933	1.782	20.481	1.998	23.034	2.276	25.591	2.613	28.151	3.011	30.709	3.467	33.265	3.981	35.824	4.551	38.385	5.177	40.884	5.858	43.400	6.590	45.900	7.374	48.382	8.208	35			
35	17.346	1.713	19.894	1.942	22.448	2.226	25.006	2.594	27.566	3.014	30.123	3.497	32.676	4.048	35.230	4.643	37.784	5.301	40.275	6.020	42.779	6.792	45.264	7.617	47.727	8.492	33			
33	16.463	1.614	19.013	1.866	21.570	2.188	24.129	2.581	26.688	3.042	29.247	3.570	31.805	4.164	34.365	4.821	36.925	5.541	39.343	6.321	41.823	7.158	44.278	8.051	46.705	8.997	30	30 (H)**		
30	15.994	1.462	17.529	1.765	20.108	2.154	22.686	2.618	25.218	3.166	27.755	3.792	30.293	4.494	32.832	5.267	35.363	6.110	37.910	7.019	40.422	7.990	42.896	9.019	44.826	10.102	25			
25	14.491	1.411	16.963	1.739	19.523	2.156	22.078	2.693	24.625	3.255	27.155	3.931	29.664	4.686	32.146	5.517	34.596	6.420	37.008	7.391	39.378	8.425	41.701	9.517			23	25 (P)*		
20	13.52	1.345	16.009	1.720	18.944	2.198	21.192	2.776	23.725	3.439	26.229	4.213	28.702	5.105	31.145	6.095	33.525	7.045	35.861	8.052							20	25 (H)**		
15	12.063	1.260	14.621	1.785	17.161	2.411	19.671	3.160	22.139	4.020	24.551	4.996	26.899	6.081													15	20 (P)*		
12	10.572	1.203	13.126	1.821	15.658	2.487	18.353	3.283	21.196	4.196	24.171	5.221															14	20 (H)**		

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle 33 Degrees

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=33°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	780.564	107.483	783.068	107.497	785.573	107.513	788.077	107.529	790.582	107.546	793.087	107.563	795.592	107.582	798.097	107.602	800.603	107.622	803.109	107.644	805.615	107.666	808.121	107.688	810.628	107.712	2500	
2200	691.704	94.614	694.209	94.630	696.714	94.647	699.219	94.666	701.724	94.685	704.230	94.705	706.736	94.726	709.242	94.749	711.748	94.772	714.255	94.796	716.762	74.821	719.269	94.847	721.777	94.874	2200	
2000	632.465	86.036	634.970	86.054	637.476	86.073	639.981	86.094	642.487	86.115	644.993	86.137	647.500	86.160	650.007	86.185	652.514	86.210	655.021	86.237	657.529	86.265	660.036	86.293	662.544	86.323	2000	
1800	573.227	77.462	575.733	77.482	578.238	77.503	580.745	77.526	583.251	77.549	585.258	77.574	588.265	77.600	590.772	77.627	593.280	77.655	595.788	77.685	598.297	77.716	600.806	77.748	603.315	77.781	1800	
1500	484.372	64.608	486.878	64.632	489.385	64.658	491.893	64.685	494.400	64.713	496.908	64.742	499.417	64.774	501.926	64.806	504.435	64.840	506.945	64.876	509.455	64.913	511.965	64.951	514.476	64.991	1500	
1200	395.520	51.770	398.029	51.800	400.537	51.832	403.046	51.865	405.556	51.901	408.066	51.938	410.576	51.977	413.087	52.017	415.599	52.060	418.111	52.104	420.623	52.150	423.136	52.198	425.650	52.248	1200	
1000	336.290	43.227	338.800	43.263	341.310	43.301	343.821	43.341	346.333	43.383	348.844	43.428	351.357	43.475	353.870	43.523	356.384	43.574	358.898	43.627	361.413	43.683	363.928	43.741	366.444	43.800	1000	
900	306.677	38.963	309.188	39.003	311.699	39.045	314.211	39.090	316.724	39.137	319.237	39.186	321.751	39.238	324.265	39.292	326.781	39.349	329.296	39.408	331.812	39.470	334.329	39.534	336.846	39.600	900	
800	277.066	34.707	279.578	34.751	282.091	34.799	284.604	34.849	287.118	34.902	289.633	34.958	292.149	35.016	294.665	35.077	297.181	35.141	299.699	35.208	302.217	35.277	304.736	35.349	307.255	35.423	800	
700	247.458	30.461	249.971	30.512	252.486	30.567	255.001	30.624	257.417	30.685	260.034	30.748	262.551	30.815	265.070	30.885	267.588	30.958	270.108	31.034	272.628	31.113	275.150	31.195	277.671	31.281	700	
600	217.854	26.233	220.369	26.292	222.886	26.356	225.404	26.423	227.922	26.493	230.441	26.567	232.961	26.646	235.482	26.727	238.004	26.812	240.527	26.901	243.050	26.993	245.574	27.089	248.099	27.188	600	
500	188.256	22.031	190.775	22.102	193.294	22.178	195.814	22.259	198.337	22.343	200.859	22.432	203.383	22.525	205.908	22.623	208.433	22.725	210.960	22.832	213.487	22.942	216.015	23.057	218.544	23.177	500	
400	158.669	17.875	161.192	17.964	163.716	18.059	166.241	18.159	168.768	18.265	171.295	18.376	173.824	18.493	176.354	18.615	178.884	18.743	181.416	18.875	183.949	19.014	186.483	19.157	189.018	19.307	400	
360	146.840	16.234	149.365	16.333	151.891	16.439	154.418	16.550	156.947	16.668	159.477	16.792	162.009	16.921	164.541	17.056	167.074	17.198	169.609	17.345	172.145	17.499	174.682	17.659	177.220	17.824	360	100 (P)*
350	143.883	15.826	146.408	15.929	148.935	16.037	151.464	16.152	153.993	16.273	156.524	16.400	159.056	16.533	161.589	16.673	164.123	16.818	166.659	16.970	169.195	17.128	171.733	17.292	174.272	17.462	350	
300	129.103	13.811	131.633	13.930	134.163	14.057	136.695	14.191	139.229	14.332	141.763	14.480	144.300	14.635	146.837	14.798	149.376	14.968	151.915	15.145	154.456	15.329	156.999	15.520	159.542	15.718	300	
250	114.335	11.849	116.869	11.992	119.404	12.144	121.941	12.304	124.480	12.473	127.020	12.651	129.561	12.837	132.104	13.032	134.648	13.235	137.193	13.447	139.739	13.668	142.287	13.897	144.836	14.135	250	
230	108.432	11.086	110.968	11.242	113.505	11.407	116.045	11.581	118.585	11.764	121.129	11.957	123.672	12.160	126.218	12.371	128.764	12.592	131.312	12.823	133.861	13.062	136.411	13.311	138.962	13.569	230	80 (P)*
200	99.584	9.978	102.124	10.157	104.666	10.347	107.209	10.547	109.754	10.758	112.301	10.979	114.849	11.212	117.398	11.455	119.949	11.709	122.501	11.973	125.053	12.248	127.607	12.534	130.162	12.830	200	
170	90.746	8.934	93.291	9.144	95.838	9.367	98.386	9.602	100.936	9.850	103.488	10.110	106.040	10.383	108.594	10.668	111.149	10.966	113.705	11.276	116.261	11.599	118.819	11.934	121.377	12.281	170	
155	86.333	8.447	88.881	8.677	91.430	8.921	93.981	9.179	96.533	9.450	99.087	9.735	101.642	10.034	104.198	10.347	106.755	10.673	109.313	11.012	111.871	11.366	114.430	11.732	116.989	12.112	155	65 (P)*
125	77.520	7.585	80.074	7.870	82.629	8.172	85.165	8.499	87.743	8.825	90.301	9.177	92.860	9.546	95.419	9.932	97.979	10.334	100.538	10.752	103.098	11.187	105.657	11.639	108.215	17.107	125	
100	70.194	7.060	72.753	7.414	75.312	7.789	77.871	8.185	80.431	8.602	82.990	9.039	85.549	9.497	88.107	9.975	90.663	10.473	93.218	10.991	95.771	11.529	98.322	12.087	100.871	12.665	100	
90	67.269	6.934	69.828	7.326	72.388	7.742	74.947	8.180	77.506	8.641	80.063	9.125	82.619	9.631	85.173	10.159	87.725	10.709	90.274	11.281	92.820	11.875	95.368	12.491	97.902	13.127	90	50 (P)
80	64.345	6.882	66.904	7.321	69.462	7.786	72.019	8.277	74.574	8.793	77.127	9.333	79.677	9.899	82.223	10.489	84.767	11.103	87.306	11.741	89.839	12.403	92.368	13.088	94.891	13.796	80	50 (H)**
70	61.419	6.934	63.975	7.433	66.529	7.961	69.080	8.518	71.628	9.103	74.171	9.715	76.709	10.355	79.242	11.021	81.769	11.715	84.288	12.435	86.801	13.181	89.305	13.952	91.800	14.749	70	
60	58.483	7.139	61.032	7.717	63.575	8.327	66.113	8.969	68.644	9.643	71.168	10.347	73.683	11.082	76.190	11.847	78.686	12.642	81.172	13.465	83.646	14.317	86.107	15.196	88.556	16.102	60	40 (P) *
55	57.006	7.324	59.547	7.951	62.081	8.611	64.607	9.306	67.124	10.034	69.632	10.595	72.129	11.568	74.614	12.413	77.086	13.268	79.545	14.154	81.989	15.068	84.418	16.012	86.830	16.983	55	
50	55.517	7.584	58.046	8.267	60.565	8.987	63.074	9.743	65.572	10.535	68.056	11.361	80.526	12.221	72.982	13.114	75.420	14.038	77.842	14.994	80.245	15.980	82.628	16.995	84.991	18.038	50	40 (H)**
45	54.006	7.942	56.516	8.692	59.014	9.481	61.498	10.309	63.966	11.175	66.417	12.077	68.849	13.014	71.261	13.985	73.652	14.988	76.021	16.024	78.367	17.089	80.687	18.184	82.982	19.306	45	35 (P)*
40	52.457	8.428	54.940	9.258	57.405	10.131	58.850	11.043	62.273	11.995	64.674	12.985	87.050	14.011	69.400	15.071	71.722	16.163	74.015	17.287							40	30 (H)**
35	50.842	9.089	53.280	10.016	55.692	10.987	58.077	12.000	60.433	13.052	62.757	14.143															35	
33	50.166	9.416	52.578	10.387	54.961	11.403	57.313	12.460	59.632	13.557																	33	30 (P)*
30	49.102	9.992	51.465	11.935	53.792	12.122																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P – Plain & Rolling Terrian **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 34 Degrees

$\Delta = 34°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_r	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	771.827	114.233	774.328	114.236	776.829	114.240	779.331	114.244	781.833	114.250	784.334	114.257	786.836	114.264	789.339	114.272	791.842	114.281	794.344	114.292	796.847	114.302	799.351	114.314	801.854	114.327	2500	
2200	680.108	100.526	682.609	100.529	685.111	100.533	687.612	100.539	690.114	100.545	692.616	100.553	695.119	100.561	697.622	100.571	700.124	100.581	702.628	100.593	705.131	100.605	707.635	100.618	710.139	100.633	2200	
2000	618.962	91.388	621.463	91.392	623.965	91.396	626.467	91.403	628.969	91.410	631.471	91.418	633.974	91.427	636.477	91.437	638.980	91.449	641.484	91.461	643.988	91.475	646.492	91.490	648.996	91.506	2000	
1800	557.816	82.250	560.318	82.254	562.819	82.260	565.321	82.266	567.823	82.274	570.326	82.283	572.829	82.294	575.332	82.305	577.836	82.318	580.340	82.332	582.844	82.347	585.349	82.363	587.854	82.381	1800	
1500	466.098	68.544	468.599	68.549	471.101	68.555	473.603	68.563	476.106	68.573	478.609	68.584	481.113	68.596	483.617	68.610	486.121	68.625	488.626	68.642	491.131	68.660	493.637	68.680	496.143	68.701	1500	
1200	374.379	54.838	376.881	54.844	379.383	54.853	381.886	54.863	384.390	54.874	386.893	54.888	389.398	54.903	391.903	54.921	394.408	54.939	396.914	54.960	399.421	54.983	401.927	55.008	404.435	55.034	1200	
1000	313.233	45.701	315.736	45.709	318.239	45.719	320.742	45.731	323.246	45.745	325.750	45.761	328.256	45.780	330.762	45.803	333.268	45.823	335.775	45.848	338.281	45.875	340.792	45.905	343.300	45.937	1000	
900	282.661	41.133	285.163	41.142	287.666	41.153	290.170	41.166	292.675	41.182	295.180	41.200	297.686	41.220	300.192	41.243	302.699	41.269	305.207	41.297	307.716	41.327	310.225	41.360	312.735	41.395	900	
800	252.088	36.565	254.591	36.575	257.094	36.587	259.599	36.602	262.104	36.620	264.609	36.640	267.116	36.664	269.623	36.689	272.131	36.718	274.640	36.749	277.150	36.783	279.660	36.820	282.171	36.860	800	
700	221.515	31.998	224.019	32.009	226.523	32.023	229.027	32.040	231.533	32.060	234.040	32.083	236.547	32.110	239.056	32.139	241.565	32.172	244.075	32.208	246.586	32.247	249.098	32.289	251.610	32.334	700	100 (P)*
600	190.943	27.431	193.447	27.444	195.951	27.460	198.457	27.480	200.964	27.504	203.471	27.531	205.980	27.562	208.490	27.596	211.001	27.635	213.512	27.676	216.025	27.722	218.538	27.771	221.053	27.823	600	
500	160.371	22.865	162.875	22.881	165.381	22.900	167.888	22.924	170.396	22.952	172.905	22.985	175.415	23.022	177.927	23.063	180.439	23.109	182.953	23.159	185.468	23.214	187.984	23.273	190.502	23.336	500	
480	129.799	18.301	132.305	18.320	134.812	18.345	137.320	18.375	139.830	18.410	142.342	18.451	144.854	18.497	147.369	18.549	149.884	18.606	152.401	18.669	154.920	18.737	157.439	18.810	159.960	18.889	480	
360	117.571	16.476	120.077	16.498	122.585	16.524	125.094	16.558	127.603	16.597	130.117	16.642	132.632	16.694	135.147	16.751	137.665	16.815	140.183	16.885	142.704	16.962	145.225	17.042	147.748	17.130	360	
350	114.514	16.020	117.020	16.042	119.528	16.070	122.038	16.104	124.549	16.145	127.062	16.191	129.576	16.244	132.092	16.303	134.610	16.369	137.129	16.440	139.650	16.518	142.172	16.602	144.696	16.692	350	
300	99.229	13.740	101.736	13.766	104.245	13.798	106.756	13.838	109.269	13.885	111.784	13.940	114.301	14.001	116.819	14.071	119.340	14.146	121.862	14.230	124.386	14.321	126.911	14.419	129.438	14.524	300	80 (P)*
250	83.944	11.462	86.452	11.493	88.963	11.532	91.477	11.580	93.992	11.636	96.510	11.702	99.030	11.776	101.552	11.858	104.076	11.950	106.602	12.050	109.129	12.159	111.659	12.276	114.191	12.402	250	
230	77.830	10.552	80.340	10.585	82.851	10.627	85.366	10.680	87.882	10.741	90.402	10.812	92.923	10.893	95.447	10.982	97.972	11.082	100.500	11.191	103.030	11.309	105.562	11.437	108.096	11.574	230	
200	68.660	9.187	71.171	9.225	73.684	9.274	76.201	9.334	78.720	9.405	81.241	9.487	83.766	9.579	86.292	9.683	88.821	9.797	91.353	9.922	93.886	10.058	96.422	10.203	98.960	10.362	200	
170	59.491	7.825	62.003	7.870	64.519	7.928	67.038	7.998	69.560	8.081	72.085	8.177	74.613	8.286	77.143	8.408	79.677	8.542	82.213	8.689	84.751	8.849	87.291	9.021	89.834	9.207	170	65 (P)*
155	54.906	7.145	57.420	7.195	59.937	7.258	62.457	7.335	64.981	7.426	67.509	7.532	70.039	7.651	72.572	7.784	75.108	7.932	77.646	8.093	80.187	8.268	82.731	8.457	85.277	8.660	155	
125	45.738	5.790	48.255	5.851	50.776	5.929	53.301	6.025	55.830	6.138	58.362	6.269	60.898	6.416	63.437	6.582	65.980	6.764	68.525	6.964	71.073	7.181	73.623	7.415	76.176	7.666	125	
100	38.100	4.667	40.621	4.743	43.146	4.841	45.676	4.961	48.211	5.102	50.750	5.265	53.293	5.450	55.839	5.656	58.388	5.884	60.940	6.133	63.495	6.403	66.052	6.695	68.611	7.008	100	
90	35.046	4.221	37.568	4.306	40.096	4.415	42.629	4.548	45.167	4.704	47.709	4.885	50.255	5.090	52.804	5.319	55.357	5.572	57.913	5.848	60.470	6.148	63.030	6.472	65.591	6.819	90	50 (P)*
80	31.992	3.778	34.517	3.873	37.040	3.993	39.564	4.147	42.125	4.321	44.671	4.525	47.221	4.755	49.774	5.012	52.330	5.296	54.889	5.606	57.449	5.943	60.011	6.306	62.574	6.695	80	50 (H)**
70	28.939	3.338	31.467	3.442	34.001	3.587	36.542	3.758	39.087	3.959	41.637	4.191	44.191	4.454	46.748	4.747	49.308	5.071	51.869	5.425	54.432	5.808	56.995	6.221	59.558	6.664	70	
60	25.888	2.905	28.419	3.032	30.958	3.195	33.503	3.394	36.054	3.628	38.608	3.899	41.167	4.205	43.727	4.546	46.290	4.922	48.853	5.333	51.416	5.778	53.978	6.257	56.539	6.770	60	40 (P)*
55	24.363	2.691	26.892	2.830	29.438	3.007	31.986	3.224	34.539	3.480	37.096	3.775	39.656	4.108	42.219	4.479	44.782	4.888	47.345	5.335	49.907	5.819	52.467	6.339	55.023	6.896	55	
50	22.838	2.480	25.375	2.633	27.919	2.829	30.470	3.066	33.026	3.347	35.586	3.671	38.148	4.036	40.711	4.444	43.274	4.892	45.836	5.382	48.394	5.911	50.949	6.481	53.499	7.089	50	40 (H)**
45	21.315	2.274	23.854	2.443	26.403	2.660	28.956	2.925	31.515	3.236	34.077	3.594	36.640	3.999	39.203	4.450	41.768	4.946	44.332	5.487	46.895	6.072	49.461	6.699	51.960	7.369	45	35 (P)**
40	19.792	2.072	22.336	2.262	24.887	2.505	27.444	2.803	30.006	3.153	32.569	3.555	35.132	4.009	37.692	4.513	40.249	5.068	42.799	5.671	45.341	6.323	47.873	7.021	50.393	7.766	40	35 (H) 30 (P)*
35	18.271	1.879	20.819	2.096	23.374	2.374	25.935	2.712	28.498	3.141	31.060	3.568	33.620	4.083	36.175	4.655	38.721	5.281	41.257	5.965	43.780	6.700	46.287	7.488	48.776	8.321	35	
33	17.663	1.804	20.212	2.034	22.770	2.329	25.331	2.687	27.895	3.109	30.456	3.593	33.014	4.138	35.564	4.742	38.104	5.404	40.631	6.123	43.142	6.897	45.634	7.724	48.106	8.601	33	
30	16.752	1.697	19.304	1.949	21.864	2.273	24.427	2.666	26.989	3.128	29.548	3.658	32.099	4.253	34.640	4.913	37.166	5.635	39.678	6.486	42.162	7.256	44.625	8.151	47.061	9.099	30	30 (H)**
25	15.235	1.533	17.783	1.835	20.355	2.222	22.918	2.691	25.475	3.240	28.021	3.868	30.552	4.571	33.062	5.347	35.547	6.192	38.002	7.107	40.423	8.077	42.806	9.109	45.147	10.194	25	
23	14.629	1.476	17.189	1.804	19.752	2.222	22.313	2.730	24.864	3.324	27.401	4.001	29.917	4.759	32.407	5.592	34.865	6.497	37.286	7.471	39.665	8.507	41.997	9.602			23	25 (P)*
20	13.722	1.402	16.284	1.777	18.846	2.257	21.400	2.836	23.937	3.511	26.450	4.278	28.931	5.131	31.374	6.066	33.771	7.076	36.117	8.155							20	25 (H)**
15	12.213	1.353	14.774	1.829	17.320	2.456	19.837	3.208	22.313	4.076	24.733	5.049	27.088	6.117													15	20 (P)*
14	11.912	1.333	14.470	1.862	17.009	2.530	19.510	3.329	21.962	4.246	24.348	5.272															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 34 Degrees

$\Delta = 34°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	804.359	114.340	806.863	114.354	809.367	114.370	811.872	114.386	814.376	114.403	816.882	114.421	819.387	114.440	821.893	114.459	824.398	114.480	826.905	114.501	829.411	114.523	831.917	114.546	834.424	114.570	2500	
2200	712.664	100.648	715.148	100.663	717.653	100.682	720.158	100.700	722.664	100.719	725.170	100.740	727.676	100.761	730.182	100.783	732.689	100.806	735.196	100.831	737.703	100.856	740.210	100.882	742.718	100.909	2200	
2000	651.501	91.522	654.006	91.541	656.512	91.559	659.017	91.580	661.524	91.601	664.030	91.623	666.537	91.647	669.044	91.671	671.551	91.697	674.058	91.723	676.566	91.751	679.074	91.780	681.583	91.810	2000	
1800	590.359	82.400	592.865	82.420	595.371	82.441	597.878	82.463	600.384	82.487	602.891	82.511	605.399	82.538	607.906	82.565	610.415	82.593	612.923	82.623	615.431	82.654	617.941	82.686	620.450	82.719	1800	
1500	498.649	68.723	501.156	68.747	503.663	68.773	506.171	68.799	508.679	68.828	511.187	68.857	513.696	68.889	516.205	68.921	518.715	68.955	521.225	68.991	523.735	69.028	526.246	69.066	528.757	69.106	1500	
1200	406.943	55.062	409.452	55.092	411.960	55.124	414.470	55.157	416.980	55.193	419.490	55.230	422.001	55.269	424.512	55.310	427.025	55.353	429.537	55.397	432.050	55.443	434.563	55.491	437.077	55.541	1200	
1000	345.810	45.970	348.320	46.006	350.831	46.044	353.342	46.085	355.854	46.127	358.366	46.172	360.879	46.219	363.393	46.268	365.907	46.319	368.421	46.372	370.937	46.428	373.452	46.485	375.969	46.545	1000	
900	315.245	41.432	317.757	41.472	320.268	41.514	322.781	41.559	325.294	41.606	327.808	41.656	330.322	41.708	332.837	41.762	335.352	41.819	337.868	41.878	340.385	41.940	342.903	42.004	345.421	42.071	900	
800	284.683	36.902	287.195	36.947	289.708	36.994	292.222	37.045	294.737	37.098	297.252	37.154	299.768	37.212	302.285	37.273	304.802	37.337	307.321	37.404	309.839	37.473	312.358	37.545	314.878	37.620	800	
700	254.123	32.382	256.637	32.434	259.153	32.488	261.668	32.546	264.185	32.606	266.702	32.670	269.220	32.737	271.739	32.807	274.259	32.880	276.779	32.956	279.300	33.036	281.822	33.118	284.344	33.204	700	
600	222.568	27.980	226.085	27.939	228.602	28.003	231.120	28.070	233.639	28.141	236.159	28.215	238.680	28.293	241.201	28.375	243.724	28.460	246.247	28.549	248.771	28.642	251.297	28.738	253.822	28.837	600	
500	193.020	23.403	195.539	23.473	198.059	23.551	200.581	23.632	203.103	23.717	205.627	23.806	208.151	23.900	210.677	23.998	213.203	24.100	215.731	24.207	218.259	24.318	220.788	24.433	223.318	24.552	500	
400	162.483	18.974	165.006	19.063	167.531	19.158	170.057	19.259	172.584	19.365	175.113	19.477	177.643	19.594	180.174	19.716	182.705	19.844	185.239	19.977	187.773	20.116	190.308	20.260	192.844	20.409	400	100 (P)*
360	150.273	17.223	152.799	17.323	155.326	17.429	157.855	17.541	160.384	17.658	162.916	17.782	165.448	17.912	167.982	18.048	170.517	18.190	173.052	18.338	175.590	18.492	178.128	18.652	180.667	18.818	360	
350	147.221	16.788	149.748	16.891	152.275	17.000	154.805	17.115	157.335	17.236	159.867	17.364	162.400	17.497	164.935	17.637	167.470	17.783	170.007	17.935	172.545	18.093	175.085	18.258	177.625	18.428	350	
300	131.967	14.626	134.497	14.756	137.029	14.883	139.562	15.017	142.097	15.158	144.633	15.307	147.171	15.463	149.710	15.626	152.250	15.796	154.791	15.973	157.334	16.158	159.878	16.350	162.423	16.549	300	
250	116.724	12.537	119.259	12.681	121.796	12.833	124.335	12.994	126.875	13.163	129.416	13.341	131.960	13.528	134.504	13.723	137.050	13.927	139.597	14.140	142.145	14.361	144.695	14.591	147.246	14.829	250	80 (P)*
230	110.632	11.720	113.169	11.876	115.709	12.041	118.250	12.216	120.792	12.400	123.336	12.594	125.882	12.797	128.429	13.009	130.978	13.230	133.528	13.461	136.079	13.701	138.631	13.951	141.184	14.210	230	
200	101.500	10.531	104.042	10.710	106.585	10.900	109.131	11.100	111.678	11.312	114.226	11.534	116.776	11.767	119.328	12.011	121.881	12.265	124.435	12.530	126.990	12.806	129.547	13.093	132.104	13.390	200	
170	92.379	9.405	94.920	9.615	97.475	9.838	100.025	10.074	102.577	10.323	105.131	10.584	107.686	10.857	110.243	11.143	112.800	11.442	115.359	11.753	117.919	12.076	120.479	12.412	123.040	12.761	170	
155	87.824	8.877	90.374	9.108	92.926	9.352	95.479	9.611	98.034	9.883	100.590	10.169	103.148	10.468	105.707	10.782	108.267	11.108	110.828	11.449	113.389	11.803	115.951	12.171	118.514	12.552	155	65 (P)*
125	78.730	7.934	81.286	8.219	83.844	8.522	86.404	8.841	88.964	9.177	91.526	9.550	94.088	9.900	96.651	10.287	99.214	10.690	101.777	11.109	104.341	11.546	106.904	11.998	109.466	12.467	125	
100	71.171	7.342	73.733	7.697	76.295	8.073	78.858	8.470	81.422	8.888	83.985	9.326	86.548	9.785	89.110	10.264	91.671	10.763	94.231	11.283	96.794	11.822	99.355	12.382	101.899	12.961	100	
90	68.153	7.189	70.716	7.582	73.280	7.999	75.843	8.438	78.406	8.900	80.968	9.385	83.528	9.893	86.087	10.422	88.644	10.974	91.198	11.548	93.750	12.143	96.298	12.760	98.843	13.399	90	50 (P)
80	65.137	7.110	67.701	7.551	70.263	8.017	72.825	8.509	75.385	9.026	77.943	9.568	80.498	10.135	83.050	10.727	85.598	11.342	88.143	11.982	90.683	12.646	93.217	13.333	95.747	14.043	80	50 (H)**
70	62.121	7.136	64.682	7.637	67.241	8.166	69.797	8.724	72.350	9.311	74.899	9.925	77.443	10.566	79.981	11.235	82.514	11.930	85.040	12.652	87.560	13.397	90.071	14.173	92.574	14.972	70	
60	59.096	7.316	61.650	7.895	64.199	8.507	66.742	9.150	69.280	9.826	71.810	10.532	74.332	11.269	76.845	12.036	79.349	12.833	81.842	13.655	84.324	14.512	86.793	15.394	89.250	16.302	60	40 (P)*
55	57.575	7.488	60.121	8.116	62.661	8.779	65.194	9.475	67.718	10.205	70.232	10.968	72.736	11.763	75.229	12.593	77.709	13.448	80.176	14.336	82.628	15.253	85.066	16.198	87.487	17.172	55	
50	56.042	7.736	58.577	8.421	61.103	9.142	63.619	9.900	66.124	10.694	68.616	11.522	71.094	12.384	73.557	13.280	76.005	14.207	78.435	15.165	80.847	16.154	83.240	17.171	85.612	18.217	50	40 (H)**
45	54.489	8.081	57.006	8.833	59.512	9.625	62.003	10.455	64.479	11.323	66.938	12.227	69.378	13.166	71.799	14.140	74.200	15.146	76.578	16.184	78.933	17.252	81.264	18.350	83.569	19.475	45	35 (P)*
40	52.899	8.555	55.390	9.388	57.862	10.262	60.316	11.178	62.748	12.132	65.158	13.124	67.543	14.153	69.902	15.215	72.235	16.311	74.538	17.438							40	30 (H)**
35	51.245	9.205	53.691	10.134	56.112	11.108	58.506	12.123	60.871	13.179	63.205	14.272															35	
33	50.353	9.528	52.974	10.501	55.367	11.520	57.728	12.580	60.056	13.680																	33	30 (P)*
30	49.467	10.097	51.839	11.141	54.176	12.233																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H : Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 35 Degrees

$\Delta = 35°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	795.747	121.325	798.248	121.329	800.750	121.333	803.251	121.337	805.753	122.343	808.255	121.350	810.757	121.357	813.260	121.365	815.762	121.375	818.265	121.385	820.768	121.396	823.272	121.407	825.776	121.420	2500	
2200	701.158	106.767	703.659	106.771	706.160	106.775	708.662	106.781	711.164	106.787	713.666	106.795	716.169	106.803	718.672	106.813	721.175	106.825	723.678	106.834	726.182	106.847	728.686	106.860	731.190	106.875	2200	
2000	638.098	97.062	640.600	97.066	643.101	97.071	645.603	97.077	648.105	97.084	650.607	97.093	653.110	97.102	655.613	97.112	658.117	97.123	660.620	97.136	663.125	97.150	665.629	97.164	668.134	97.180	2000	
1800	575.039	87.357	577.540	87.361	580.042	87.367	582.544	87.373	585.046	87.381	587.549	87.391	590.052	87.401	592.555	87.412	595.059	87.425	597.563	87.439	600.068	87.454	602.573	87.471	605.078	87.488	1800	
1500	480.450	72.800	482.951	72.805	485.453	72.811	487.956	72.819	490.456	72.829	492.962	72.840	495.465	72.852	497.969	72.866	500.474	72.881	502.979	72.898	505.484	72.916	507.990	72.936	510.496	72.957	1500	
1200	385.861	58.243	388.363	58.249	390.865	58.255	393.368	58.267	395.872	58.279	398.375	58.293	400.880	58.308	403.385	58.325	405.891	58.344	408.397	58.365	410.904	58.388	413.411	58.413	415.918	58.439	1200	
1000	322.802	48.538	325.304	48.546	327.807	48.556	330.310	48.568	332.814	48.582	335.319	48.599	337.825	48.617	340.331	48.638	342.837	48.661	345.345	48.686	347.853	48.713	350.361	48.743	352.871	48.774	1000	
900	291.272	43.687	293.774	43.695	296.278	43.706	298.781	43.719	301.286	43.735	303.792	43.753	306.298	43.774	308.804	43.797	311.312	43.823	313.820	43.851	316.329	43.881	318.838	43.914	321.349	43.949	900	
800	259.742	38.835	262.245	38.845	264.749	38.857	267.253	38.872	269.759	38.890	272.265	38.910	274.771	38.934	277.279	38.959	279.787	38.988	282.297	39.020	284.806	39.053	287.317	39.090	289.828	39.130	800	
700	228.213	33.984	230.716	33.995	233.221	34.009	235.726	34.026	238.232	34.047	240.738	34.070	243.246	34.096	245.755	34.126	248.264	34.159	250.775	34.195	253.286	34.234	255.798	34.276	258.311	34.321	700	100 (P)*
600	196.684	29.134	199.188	29.146	201.693	29.163	204.199	29.183	206.705	29.206	209.213	29.234	211.722	29.265	214.232	29.299	216.743	29.337	219.255	29.379	221.768	29.425	224.282	29.474	226.797	29.527	600	
500	165.155	24.284	167.660	24.299	170.165	24.319	172.672	24.343	175.181	24.371	177.690	24.404	180.201	24.441	182.713	24.483	185.226	24.529	187.740	24.579	190.256	24.634	192.772	24.692	195.290	24.756	500	
400	133.627	19.436	136.132	19.455	138.640	19.480	141.148	19.510	143.659	19.545	146.170	19.586	148.684	19.633	151.198	19.685	153.714	19.742	156.232	19.805	158.751	19.873	161.271	19.947	163.793	20.026	400	
360	121.016	17.498	123.532	17.519	126.050	17.546	128.569	17.580	131.091	17.619	133.614	17.664	136.078	17.716	138.595	17.774	141.113	17.837	143.632	17.907	146.153	17.983	148.675	18.065	151.199	18.153	360	
330	111.863	17.013	120.369	17.035	122.877	17.063	125.387	17.097	127.899	17.136	130.412	17.185	132.927	17.238	135.444	17.297	137.962	17.363	140.482	17.434	143.004	17.512	145.527	17.596	148.051	17.687	330	
300	102.099	14.591	104.607	14.617	107.116	14.650	109.628	14.690	112.141	14.737	114.657	14.792	117.174	14.854	119.693	14.923	122.214	14.999	124.737	15.083	127.262	15.174	129.788	15.272	132.316	15.377	300	80 (P)*
250	86.336	12.171	88.845	12.202	91.356	12.241	93.870	12.289	96.386	12.346	98.904	12.412	101.425	12.486	103.948	12.569	106.472	12.661	108.999	12.761	111.528	12.870	114.059	12.988	116.592	13.114	250	
230	80.031	11.204	82.541	11.238	85.053	11.280	87.568	11.333	90.085	11.394	92.605	11.465	95.127	11.546	97.652	11.636	100.178	11.736	102.707	11.845	105.238	11.964	107.771	12.092	110.306	12.229	230	
200	70.574	9.755	73.085	9.793	75.599	9.842	78.116	9.902	80.636	9.973	83.158	10.055	85.683	10.148	88.211	10.252	90.741	10.366	93.273	10.492	95.808	10.628	98.346	10.775	100.885	0.933	200	65 (P)*
170	61.118	8.308	63.630	8.353	66.147	8.410	68.666	8.481	71.189	8.565	73.715	8.661	76.244	8.770	78.776	8.892	81.310	9.027	83.848	9.174	86.387	9.334	88.929	9.507	91.474	9.693	170	
155	56.390	7.585	58.904	7.635	61.422	7.698	63.943	7.776	66.468	7.867	68.996	7.973	71.527	8.092	74.061	8.226	76.599	8.374	79.139	8.535	81.681	8.711	84.226	8.901	86.774	9.104	155	
125	46.935	6.145	49.452	6.206	51.974	6.284	54.500	6.380	57.030	6.494	59.563	6.625	62.101	6.773	64.641	6.939	67.185	7.122	69.732	7.322	72.282	7.539	74.833	7.774	77.389	8.026	125	
100	39.038	4.951	41.579	5.028	44.105	5.126	46.637	5.246	49.173	5.387	51.713	5.551	54.257	5.736	56.806	5.943	59.357	6.171	61.911	6.421	64.469	6.692	67.028	6.984	69.590	7.298	100	50 (P)*
90	35.008	4.427	38.431	4.562	40.960	4.671	43.494	4.804	46.033	4.961	48.577	5.143	51.125	5.348	53.677	5.578	56.232	5.831	58.790	6.108	61.350	6.409	63.913	6.733	66.477	7.081	90	
80	32.759	4.008	35.284	4.101	37.816	4.223	40.354	4.373	42.897	4.550	45.444	4.754	47.996	4.985	50.552	5.243	53.111	5.527	55.672	5.835	58.236	6.176	60.801	6.540	63.367	6.930	80	50 (H)**
70	29.610	3.537	32.138	3.646	34.675	3.787	37.217	3.958	39.764	4.160	42.316	4.393	44.872	4.656	47.432	4.950	49.995	5.275	52.559	5.629	55.126	6.014	57.693	6.428	60.260	6.872	70	
60	26.463	3.075	28.996	3.203	31.536	3.366	34.083	3.566	36.636	3.801	39.193	4.072	41.754	4.379	44.318	4.721	46.884	5.098	49.451	5.510	52.018	5.956	54.585	6.437	57.149	6.951	60	40 (P)*
55	24.890	2.848	27.426	2.986	29.969	3.165	32.519	3.382	35.074	3.639	37.634	3.934	40.197	4.268	42.763	4.640	45.330	5.051	47.897	5.499	50.464	5.984	53.028	6.506	55.589	7.064	55	
50	23.318	2.623	25.857	2.775	28.401	2.971	30.956	3.210	33.514	3.492	36.077	3.817	38.642	4.183	41.209	4.591	43.776	5.041	46.342	5.532	48.906	6.063	51.466	6.634	54.021	7.244	50	40 (H)**
45	21.747	2.402	24.289	2.521	26.838	2.689	29.395	2.914	31.956	3.207	34.521	3.576	37.088	4.032	39.655	4.584	42.221	5.242	44.784	5.624	47.342	6.210	49.894	6.840	52.439	7.511	45	35 (P)*
40	20.177	2.187	22.722	2.337	25.276	2.521	27.836	2.749	30.400	3.020	32.967	3.342	35.534	3.728	38.100	4.184	40.667	5.190	43.217	5.795	45.765	6.448	48.304	7.149	50.830	7.896	40	35 (H) 30 (P)*
35	18.608	1.979	21.158	2.196	23.716	2.475	26.280	2.815	28.846	3.214	31.413	3.673	33.978	4.189	36.539	4.763	39.090	5.392	41.632	6.076	44.161	6.813	46.676	7.601	49.172	8.439	35	
33	17.981	1.899	20.533	2.129	23.091	2.425	25.638	2.784	28.225	3.207	30.791	3.692	33.354	4.238	35.909	4.844	38.455	5.508	40.989	6.229	43.507	7.005	46.007	7.834	48.486	8.714	33	
30	17.042	1.783	19.597	2.010	22.159	2.360	24.725	2.755	27.292	3.216	29.859	3.749	32.423	4.346	34.989	5.008	37.492	5.731	40.008	6.515	42.503	7.357	44.974	8.255	47.419	9.205	30	30 (H)**
25	15.478	1.605	18.038	1.908	20.603	2.296	23.171	2.799	25.733	3.417	28.295	3.946	30.852	4.651	33.340	5.529	35.833	6.277	38.296	7.191	40.726	8.167	43.118	9.201	45.469	10.290	25	
23	14.851	1.542	17.416	1.871	19.983	2.291	22.546	2.900	25.105	3.596	27.668	4.035	30.171	4.834	32.668	5.670	35.134	6.578	37.564	7.554	39.953	8.593	42.296	9.691			23	25 (P)*
20	13.918	1.460	16.484	1.837	19.050	2.317	21.609	2.998	24.152	3.875	26.672	4.343	29.191	5.199	31.612	6.117	34.019	7.150	36.375	8.232							20	25 (H)**
15	12.363	1.377	14.928	1.875	17.480	2.504	20.004	3.256	22.487	4.127	24.917	5.103	27.281	6.174													15	20 (P)*
14	12.032	1.374	14.615	1.905	17.159	2.575	19.669	3.376	22.129	4.296	24.525	5.324															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 35 Degrees

$\Delta = 35°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	828.280	121.434	830.784	121.448	833.288	121.463	835.793	121.479	838.298	121.497	840.803	121.514	843.309	121.533	845.815	121.553	848.321	121.573	850.827	121.595	853.333	121.617	855.840	121.640	858.713	421.664	2500	
2200	733.694	106.890	736.199	106.906	738.704	106.924	741.210	106.942	743.716	106.962	746.221	106.982	748.728	107.003	751.234	107.026	753.741	107.049	756.248	107.073	758.756	107.099	761.263	107.125	763.771	107.152	2200	
2000	670.638	97.197	673.144	97.215	675.649	97.234	678.155	97.254	680.662	97.276	683.168	97.298	685.675	97.322	688.182	97.346	690.690	97.372	693.198	97.399	695.706	97.427	698.214	97.455	700.723	97.485	2000	
1800	607.583	87.507	610.089	87.527	612.595	87.548	615.102	87.571	617.609	87.594	620.116	87.619	622.624	87.645	625.132	87.673	627.640	87.701	630.149	87.731	632.658	87.762	635.167	87.794	637.677	87.827	1800	
1500	513.003	72.979	515.510	73.003	518.018	73.029	520.525	73.056	523.033	73.084	525.542	73.114	528.051	73.146	530.561	73.178	533.071	73.212	535.581	73.248	538.092	73.285	540.603	73.324	543.114	73.364	1500	
1200	418.427	58.467	420.936	58.498	423.445	58.529	425.955	58.563	428.465	58.598	430.976	58.636	433.487	58.675	435.999	58.716	438.511	58.759	441.024	58.803	443.537	58.850	446.051	58.898	448.565	58.948	1200	
1000	355.380	48.408	357.891	48.844	360.402	48.883	362.913	48.923	365.426	48.966	367.938	49.010	370.452	49.057	372.966	49.106	375.480	49.158	377.996	49.211	380.511	49.267	383.028	49.325	385.544	49.385	1000	
900	323.859	43.987	326.371	44.027	328.883	44.069	331.396	44.114	333.909	44.161	336.424	44.211	338.938	44.263	341.454	44.318	343.970	44.375	346.487	44.434	349.004	44.496	351.522	44.560	354.041	44.627	900	
800	292.341	39.172	294.854	39.218	297.367	39.265	299.881	39.316	302.396	39.369	304.912	39.425	307.429	39.484	309.946	39.545	312.464	39.609	314.983	39.676	317.502	39.746	320.022	39.818	322.543	39.893	800	
700	260.825	34.569	263.339	34.421	265.855	34.476	268.371	34.533	270.888	34.594	273.406	34.658	275.925	34.725	278.444	34.795	280.964	34.869	283.486	34.945	286.007	35.024	288.530	35.107	291.053	35.193	700	
600	229.313	29.583	231.830	29.643	234.348	29.707	236.867	29.774	239.386	29.845	241.907	29.920	244.429	29.998	246.951	30.080	249.474	30.166	251.999	30.255	254.524	30.347	257.050	30.444	259.576	30.543	600	
500	197.809	24.823	200.329	24.895	202.850	24.972	205.372	25.053	207.895	25.138	210.420	25.227	212.945	25.321	215.471	25.419	217.999	25.522	220.527	25.629	223.056	25.740	225.587	25.856	228.118	25.976	500	
400	166.316	20.110	168.841	20.200	171.366	20.296	173.893	20.397	176.422	20.503	178.951	20.615	181.482	20.732	184.014	20.855	186.547	20.983	189.081	21.117	191.617	21.256	194.153	21.400	196.691	21.550	400	
360	153.724	18.247	156.251	18.347	158.779	13.453	161.309	18.565	163.840	18.683	166.372	18.807	168.906	18.938	171.441	19.074	173.977	19.216	176.514	19.365	179.053	19.519	181.593	19.679	184.134	19.846	360	100 (P)*
350	150.577	17.783	153.105	17.886	155.634	17.995	158.164	18.111	160.696	18.232	163.229	18.360	165.763	18.494	168.299	18.634	170.836	18.781	173.374	18.933	175.913	19.092	178.454	19.257	180.996	19.428	350	
300	134.866	15.490	137.377	15.610	139.910	15.737	142.445	15.872	144.981	16.013	147.518	16.162	150.057	16.319	152.598	16.482	155.139	16.653	157.682	16.831	160.227	17.016	162.772	17.208	165.319	17.407	300	
250	119.127	13.250	121.663	13.384	124.201	13.546	126.741	13.707	129.283	13.877	131.826	14.056	134.371	14.243	136.917	14.439	139.465	14.644	142.014	14.857	144.564	15.078	147.116	15.309	149.669	15.548	250	
230	112.844	12.376	115.383	12.532	117.923	12.698	120.466	12.873	123.010	13.058	125.556	13.252	128.104	13.455	130.653	13.668	133.203	13.890	135.755	14.122	138.309	14.363	140.863	14.613	143.419	14.872	230	80 (P)*
200	103.426	11.102	105.970	11.281	108.515	11.472	111.062	11.673	113.611	11.885	116.162	12.108	118.714	12.342	121.268	12.586	123.823	12.841	126.380	13.107	128.937	13.384	131.497	13.671	134.057	13.969	200	
175	94.021	9.891	96.569	10.103	99.120	10.326	101.673	10.563	104.227	10.812	106.783	11.074	109.341	11.348	111.903	11.635	114.460	11.934	117.022	12.246	119.584	12.570	122.148	12.907	124.713	13.257	175	
155	89.324	9.322	91.876	9.553	94.430	9.798	96.985	10.057	99.543	10.330	102.102	10.617	104.662	10.917	107.224	11.231	109.787	11.559	112.351	11.901	114.916	12.256	117.481	12.624	120.047	13.006	155	65 (P)*
125	79.946	8.295	82.505	8.581	85.066	8.884	87.628	9.204	90.192	9.541	92.757	9.895	95.322	10.266	97.889	10.654	100.455	11.058	103.023	11.479	105.590	11.916	108.157	12.370	110.724	12.840	125	
100	72.153	7.633	74.718	7.989	77.284	8.366	79.851	8.764	82.418	9.183	84.985	9.622	87.552	10.082	90.119	10.563	92.685	11.064	95.249	11.585	97.812	12.126	100.373	12.687	102.932	13.268	100	
90	69.043	7.453	71.609	7.847	74.176	8.265	76.744	8.705	79.311	9.169	81.877	9.655	84.442	10.164	87.006	10.695	89.568	11.248	92.127	11.823	94.684	12.420	97.238	13.039	99.789	13.679	90	50 (P)
80	65.935	7.346	68.502	7.788	71.069	8.256	73.635	8.749	76.199	9.268	78.762	9.811	81.322	10.380	83.880	10.973	86.434	11.590	88.984	12.232	91.530	12.897	94.071	13.586	96.607	14.298	80	30 (H)**
70	62.827	7.345	65.392	7.847	67.956	8.378	70.517	8.938	73.075	9.526	75.630	10.141	78.180	10.785	80.725	11.455	83.264	12.152	85.797	12.876	88.323	13.626	90.841	14.401	93.351	15.202	70	
60	59.712	7.499	62.271	8.079	64.826	8.693	67.375	9.338	69.919	10.015	72.455	10.724	74.984	11.463	77.504	12.232	80.015	13.030	82.516	13.858	85.005	14.714	87.483	15.598	89.948	16.509	60	40 (P)*
55	58.147	7.638	60.699	8.287	63.245	8.952	65.784	9.650	68.315	10.382	70.836	11.147	73.347	11.945	75.847	12.774	78.335	13.633	80.810	14.524	83.271	15.443	85.717	16.392	88.147	17.368	55	
50	56.570	7.892	59.112	8.579	61.645	9.303	64.168	10.063	66.679	10.859	69.179	11.689	71.665	12.554	74.136	13.451	76.592	14.381	79.031	15.342	81.452	16.333	83.854	17.354	86.237	18.402	50	40 (H)**
45	54.974	8.225	57.499	8.979	60.011	9.773	62.510	10.603	64.994	11.475	67.461	12.382	69.911	13.324	72.341	14.300	74.750	15.309	77.138	16.350	79.503	17.421	81.844	18.522	84.159	19.650	45	35 (P)*
40	53.344	8.687	55.841	9.522	58.322	10.399	65.784	11.317	63.225	12.274	65.644	13.268	68.038	14.300	70.408	15.365	72.750	16.464	75.064	17.594							40	30 (H)**
35	51.649	9.325	54.104	10.257	56.534	11.233	58.937	12.251	61.312	13.310	63.656	14.406															35	
33	50.942	9.643	53.372	10.620	55.774	11.640	57.145	12.703	60.484	13.806																	33	30 (P)*
30	49.833	10.206	52.216	11.255	54.562	12.348																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 36 Degrees

$\Delta = 36°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed Limit
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	819.800	128.659	822.301	128.662	824.802	128.667	827.303	128.671	829.805	128.677	832.307	128.683	834.810	128.691	837.312	128.699	839.815	128.708	842.318	128.719	844.821	128.729	847.325	128.741	849.829	128.754	2500	
2250	722.324	113.221	724.825	113.223	727.326	113.229	729.828	113.235	732.330	113.241	734.833	113.249	737.335	113.257	739.838	113.267	742.341	113.277	744.844	113.288	747.348	113.301	749.853	113.314	752.357	113.329	2250	
2000	617.340	102.928	619.842	102.933	622.343	102.938	624.845	102.944	627.347	102.951	629.850	102.959	632.353	102.969	634.856	102.979	637.359	102.990	639.863	103.003	642.367	103.017	644.872	103.032	647.376	103.048	2000	
1800	592.357	92.637	594.858	92.642	597.360	92.647	599.862	92.654	602.364	92.662	604.867	92.671	607.370	92.681	609.874	92.693	612.377	92.706	614.882	92.719	617.386	92.735	619.891	92.751	622.397	92.769	1800	
1500	494.881	77.200	497.383	77.205	499.885	77.211	502.387	77.219	504.890	77.229	507.394	77.240	509.897	77.252	512.401	77.266	514.906	77.281	517.411	77.299	519.917	77.317	522.423	77.336	524.929	77.358	1500	
1200	397.406	61.763	399.908	61.769	402.410	61.777	404.913	61.787	407.417	61.799	409.921	61.813	412.426	61.829	414.931	61.846	417.437	61.865	419.943	61.886	422.450	61.909	424.958	61.934	427.466	61.960	1200	
1000	332.422	51.472	334.925	51.490	337.428	51.490	339.932	51.502	342.436	51.516	344.941	51.532	347.446	51.551	349.953	51.572	352.460	51.595	354.967	51.620	357.475	51.647	359.984	51.677	362.494	51.708	1000	
900	299.931	46.327	302.434	46.333	304.937	46.346	307.441	46.360	309.946	46.375	312.451	46.394	314.958	46.415	317.464	46.438	319.972	46.463	322.480	46.491	324.990	46.521	327.500	46.554	330.010	46.590	900	
800	267.439	41.182	269.942	41.192	272.446	41.204	274.950	41.219	277.456	41.237	279.962	41.257	282.469	41.281	284.977	41.307	287.486	41.335	289.995	41.367	292.505	41.401	295.016	41.438	297.528	41.478	800	100 (P)*
700	234.948	36.038	237.451	36.049	239.956	36.063	242.461	36.080	244.967	36.100	247.474	36.124	249.982	36.150	252.491	36.180	255.001	36.213	257.511	36.249	260.023	36.288	262.535	36.330	265.049	36.375	700	
600	202.457	30.894	204.961	30.906	207.466	30.923	209.972	30.943	212.479	30.967	214.987	30.994	217.496	31.025	220.007	31.060	222.518	31.098	225.030	31.140	227.544	31.186	230.058	31.235	232.574	31.288	600	
550	169.966	25.751	172.470	25.766	174.976	25.786	177.484	25.810	179.992	25.838	182.502	25.871	185.013	25.908	187.525	25.950	190.039	25.996	192.554	26.047	195.070	26.101	197.587	26.160	200.105	26.224	550	
500	137.475	20.610	139.981	20.629	142.489	20.653	144.998	20.683	147.508	20.719	150.020	20.760	152.534	20.807	155.049	20.859	157.566	20.916	160.084	20.979	162.604	21.047	165.125	21.121	167.647	21.201	500	
450	124.479	18.554	126.986	18.575	129.494	18.602	132.004	18.636	134.516	18.676	137.029	18.721	139.544	18.773	142.061	18.831	144.579	18.895	147.099	18.964	149.621	19.040	152.144	19.123	154.669	19.211	450	
400	121.220	18.040	123.737	18.062	126.245	18.090	128.756	18.125	131.268	18.165	133.781	18.212	136.297	18.265	138.814	18.325	141.333	18.390	143.854	18.462	146.376	18.541	148.900	18.625	151.425	18.716	400	
350	104.986	15.671	107.494	15.697	110.003	15.730	112.513	15.770	115.029	15.818	117.545	15.872	120.063	15.934	122.583	15.804	125.105	15.880	127.628	15.964	130.154	16.055	132.681	16.154	135.210	16.260	350	80 (P)*
325	88.742	12.905	91.251	12.936	93.763	12.975	96.277	13.023	98.793	13.080	101.312	13.146	103.833	13.220	106.357	13.303	108.883	13.396	111.410	13.496	113.940	13.605	116.472	13.724	119.006	13.851	325	
300	82.244	11.879	84.754	11.912	87.267	11.955	89.782	12.008	92.300	12.070	94.821	12.141	97.343	12.222	99.869	12.312	102.396	12.412	104.926	12.522	107.458	12.641	109.993	12.769	112.529	12.907	300	
275	72.499	10.343	75.010	10.380	77.525	10.429	80.042	10.490	82.562	10.561	85.085	10.643	87.611	10.736	90.140	10.840	92.671	10.955	95.205	11.080	97.741	11.217	100.279	11.365	102.820	11.523	275	
250	62.754	8.807	65.267	8.852	67.784	8.910	70.304	8.980	72.828	9.064	75.354	9.161	77.884	9.270	80.417	9.392	82.953	9.527	85.492	9.675	88.033	9.836	90.577	10.009	93.123	10.196	250	65 (P)*
225	57.882	8.060	60.396	8.090	62.914	8.153	65.436	8.231	67.962	8.323	70.491	8.429	73.023	8.549	75.559	8.683	78.098	8.831	80.639	8.993	83.183	9.169	85.730	9.359	88.280	9.563	225	
200	48.138	6.512	50.656	6.573	53.178	6.652	55.705	6.748	58.236	6.862	60.771	6.993	63.310	7.142	65.852	7.308	68.398	7.491	70.947	7.692	73.498	7.910	76.053	8.145	78.610	8.396	200	
180	40.021	5.745	42.543	5.821	45.070	5.920	47.602	5.940	50.140	5.682	52.682	5.846	55.228	6.031	57.778	6.239	60.331	6.468	62.888	6.718	65.448	6.990	68.010	7.284	70.575	7.598	180	
160	36.715	4.741	39.299	4.826	41.829	4.936	44.364	5.069	46.905	5.227	49.450	5.409	52.000	5.615	54.554	5.845	57.111	6.099	59.671	6.377	62.235	6.679	64.800	7.004	67.368	7.353	160	50 (P)*
140	33.529	4.260	36.056	4.336	38.582	4.432	41.128	4.609	43.673	4.787	46.222	4.991	48.776	5.223	51.334	5.481	53.895	5.767	56.460	6.079	59.026	6.417	61.595	6.782	64.165	7.173	140	
120	30.285	3.743	32.811	3.853	35.352	3.993	37.895	4.165	40.444	4.367	42.999	4.601	45.557	4.865	48.120	5.160	50.685	5.485	53.253	5.841	55.823	6.226	58.394	6.642	60.965	7.087	120	
100	27.042	3.252	29.576	3.380	32.118	3.543	34.667	3.743	37.221	3.979	39.781	4.251	42.345	4.559	44.912	4.902	47.481	5.280	50.052	5.693	52.623	6.141	55.194	6.622	57.764	7.138	100	40 (P)*
85	25.421	3.010	27.958	3.149	30.503	3.327	33.054	3.545	35.612	3.803	38.175	4.099	40.741	4.434	43.310	4.807	45.881	5.219	48.452	5.668	51.023	6.154	53.592	6.678	56.159	7.237	85	
80	23.801	2.770	26.341	2.923	28.889	3.120	31.444	3.359	34.005	3.642	36.571	3.967	39.139	4.333	41.710	4.744	44.281	5.195	46.852	5.687	49.420	6.220	51.986	6.792	54.547	7.404	80	40 (H)**
75	22.182	2.535	24.725	2.705	27.277	2.923	29.836	3.189	32.400	3.502	34.968	3.863	37.539	4.276	40.110	4.723	42.681	5.222	45.254	5.766	47.832	6.353	50.370	6.985	52.921	7.658	75	35 (P)*
70	20.564	2.305	23.111	2.496	25.667	2.741	28.230	3.039	30.798	3.391	33.368	3.793	35.939	4.252	38.509	4.779	41.076	5.316	43.647	5.923	46.191	6.578	48.736	7.281	51.270	8.020	70	35 (H) 30 (P)*
65	18.948	2.082	21.499	2.300	24.060	2.580	26.627	2.920	29.197	3.321	31.768	3.781	34.338	4.299	36.903	4.874	39.461	5.505	42.009	6.191	44.545	6.930	47.066	7.720	49.571	8.560	65	
60	18.302	1.996	20.855	2.228	23.418	2.524	25.986	2.884	28.557	3.308	31.128	3.795	33.695	4.342	36.256	4.950	38.809	5.616	41.349	6.339	43.874	7.117	46.382	7.948	48.869	8.831	60	
55	17.333	1.872	19.890	2.136	22.456	2.451	25.026	2.847	27.597	3.311	30.166	3.844	32.728	4.442	35.281	5.106	37.820	5.831	40.343	6.617	42.846	7.462	45.325	8.362	47.779	9.315	55	30 (H)**
50	15.722	1.680	18.285	1.984	20.855	2.372	23.426	2.844	25.993	3.396	28.551	4.027	31.094	4.734	33.619	5.514	36.119	6.364	38.591	7.281	41.030	8.259	43.432	9.297	45.792	10.389	50	
45	15.079	1.611	17.644	1.940	20.215	2.362	22.785	2.872	25.347	3.469	27.896	4.150	30.426	4.912	32.931	5.758	35.406	6.660	37.845	7.639	40.243	8.681	42.596	9.782			45	25 (P)*
40	14.115	1.520	16.684	1.898	19.255	2.379	21.819	2.962	24.368	3.640	26.895	4.412	29.392	5.270	31.852	6.210	34.268	7.226	36.634	8.311							40	25 (H)**
35	12.513	1.423	15.083	1.922	17.640	2.553	20.171	3.309	22.663	4.181	25.101	5.199	27.475	6.233													35	20 (P)*
30	12.193	1.417	14.761	1.950	17.311	2.622	19.828	3.428	22.297	4.347	24.702	5.378															30	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 19 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 36 Degrees

$\Delta = 36°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metres	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metres	
2500	852.233	128.788	854.837	128.782	857.342	128.797	859.847	128.813	862.352	128.831	864.857	128.849	867.363	128.867	869.868	128.887	872.375	128.908	874.882	128.929	877.389	128.952	879.896	128.975	882.403	128.999	2500	
2200	754.862	113.344	757.367	113.361	759.872	113.378	762.377	113.396	764.884	113.416	767.390	113.436	769.896	113.458	772.403	113.480	774.910	113.503	777.417	113.528	779.925	113.553	782.433	113.580	784.941	113.607	2200	
2000	689.882	103.064	692.387	103.083	694.893	103.102	697.399	103.122	699.906	103.143	702.412	103.166	704.919	103.189	707.427	103.214	709.935	103.240	712.443	103.267	714.951	103.294	717.460	103.323	719.969	103.354	2000	
1800	624.902	92.788	627.408	92.808	629.915	92.829	632.422	92.852	634.929	92.875	637.436	92.900	639.944	92.926	642.452	92.954	644.961	92.982	647.470	93.012	649.979	93.043	652.489	93.075	654.999	93.109	1800	
1500	527.436	77.380	529.943	77.404	532.451	77.430	534.959	77.457	537.468	77.485	539.976	77.515	542.486	77.547	544.996	77.580	547.506	77.614	550.017	77.650	552.528	77.687	555.039	77.725	557.551	77.766	1500	
1200	423.974	61.988	432.483	62.019	434.992	62.050	437.503	62.084	440.013	62.120	442.524	62.157	445.036	62.196	447.548	62.238	450.061	62.280	452.574	62.325	455.088	62.372	457.602	62.420	460.116	62.470	1200	
1000	365.004	51.742	367.515	51.779	370.026	51.817	372.538	51.857	375.051	51.900	377.564	51.945	380.078	51.992	382.592	52.042	385.107	52.093	387.623	52.146	390.139	52.202	392.656	52.260	395.173	52.321	1000	
900	332.521	46.628	335.033	46.668	337.546	46.710	340.059	46.755	342.573	46.803	345.087	46.853	347.603	46.905	350.118	46.959	352.635	47.016	355.152	47.076	357.670	47.138	360.189	47.203	362.708	47.270	900	
800	300.040	41.520	302.554	41.565	305.068	41.613	307.583	41.664	310.098	41.717	312.615	41.773	315.132	41.832	317.649	41.894	320.168	41.958	322.687	42.025	325.207	42.095	327.728	42.167	330.249	42.243	800	
700	267.563	36.424	270.078	36.476	272.594	36.531	275.111	36.588	277.628	36.649	280.147	36.713	282.666	36.781	285.187	36.851	287.707	36.925	290.229	37.001	292.752	37.081	295.275	37.164	297.799	37.250	700	
600	235.090	31.344	237.608	31.405	240.126	31.469	242.645	31.536	245.166	31.607	247.687	31.682	250.209	31.761	252.732	31.843	255.257	31.928	257.781	32.018	260.307	32.111	262.834	32.208	265.362	32.308	600	
500	202.624	26.292	205.145	26.364	207.667	26.441	210.190	26.522	212.714	26.607	215.239	26.697	217.765	26.791	220.292	26.889	222.821	26.992	225.350	27.099	227.880	27.211	230.412	27.327	232.944	27.447	500	
400	170.171	21.246	172.696	21.376	175.223	21.471	177.751	21.573	180.280	21.679	182.811	21.792	185.342	21.909	187.876	22.032	190.410	22.161	192.945	22.295	195.482	22.434	198.020	22.579	200.559	22.729	400	
360	157.195	19.305	159.723	19.405	162.252	19.512	164.783	19.624	167.315	19.742	169.848	19.867	172.383	19.998	174.919	20.134	177.456	20.277	179.995	20.426	182.535	20.581	185.076	20.741	187.619	20.908	360	
300	133.952	15.813	136.480	15.916	139.010	19.025	161.542	19.141	164.074	19.263	166.609	19.391	169.144	19.525	171.681	19.666	174.219	19.812	176.759	19.965	179.300	20.125	181.842	20.290	184.386	20.462	300	
250	121.542	13.986	124.080	14.130	126.619	14.283	129.161	14.445	131.704	14.615	134.249	14.795	136.795	14.982	139.343	15.179	141.893	15.384	144.444	15.598	146.997	15.820	149.551	16.051	152.106	16.291	250	
230	115.067	13.054	117.608	13.211	120.150	13.377	122.694	13.553	125.240	13.738	127.788	13.932	130.338	14.136	132.889	14.350	135.441	14.573	137.995	14.805	140.551	15.046	143.108	15.297	145.666	15.557	230	
200	105.363	11.692	107.908	11.873	110.455	12.064	113.004	12.265	115.555	12.478	118.108	12.702	120.662	12.936	123.218	13.181	125.776	13.437	128.335	13.703	130.895	13.981	133.457	14.268	136.020	14.567	200	
175	95.471	10.395	98.222	10.606	100.775	10.831	103.330	11.068	105.886	11.318	108.445	11.580	111.005	11.855	113.567	12.143	116.130	12.443	118.694	12.756	121.260	13.081	123.826	13.419	126.394	13.769	175	
150	83.832	9.781	85.386	10.013	95.942	10.259	98.500	10.519	101.060	10.793	103.621	11.080	106.185	11.381	108.749	11.696	111.315	12.025	113.882	12.364	116.450	12.724	119.019	13.093	121.589	13.476	150	
125	81.169	8.648	83.731	8.955	86.294	9.259	88.860	9.580	91.426	9.918	93.994	10.273	96.563	10.644	99.133	11.033	101.704	11.438	104.275	11.861	106.846	12.299	109.418	12.754	111.989	13.226	125	
100	73.141	7.934	75.709	8.291	78.279	8.669	80.849	9.068	83.420	9.488	85.991	9.929	88.563	10.390	91.133	10.872	93.704	11.374	96.275	11.897	98.847	12.440	101.407	13.002	103.972	13.584	100	
90	69.937	7.723	72.507	8.121	75.078	8.540	77.649	8.981	80.221	9.446	82.791	9.934	85.361	10.444	87.930	10.976	90.497	11.531	93.063	12.108	95.624	12.707	98.184	13.327	100.740	13.969	90	50 (F)
80	66.736	7.591	69.307	8.034	71.878	8.503	74.449	8.998	77.018	9.518	79.586	10.063	82.152	10.633	84.715	11.227	87.274	11.846	89.831	12.490	92.383	13.157	94.930	13.848	97.472	14.562	80	50 (H)**
70	63.536	7.562	66.107	8.065	68.675	8.598	71.242	9.159	73.805	9.748	76.365	10.366	78.921	11.011	81.472	11.683	84.018	12.382	86.557	13.108	89.090	13.860	91.615	14.637	94.133	15.440	70	
60	60.331	7.687	62.896	8.270	65.456	8.885	68.011	9.532	70.561	10.211	73.104	10.921	75.640	11.662	78.167	12.434	80.685	13.235	83.194	14.065	85.691	14.923	88.177	15.810	90.650	16.723	60	40 (F)*
55	58.722	7.633	61.280	8.464	63.832	9.130	66.377	9.831	68.914	10.565	71.443	11.332	73.962	12.132	76.469	12.963	78.965	13.826	81.448	14.718	83.918	15.640	86.372	16.591	88.811	17.570	55	
50	57.101	8.054	59.649	8.743	62.189	9.469	64.719	10.221	67.238	11.029	69.745	11.862	72.239	12.729	74.719	13.629	77.183	14.561	79.631	15.525	82.061	16.519	84.472	17.542	86.864	18.594	50	40 (H)**
45	55.463	8.374	57.994	9.130	60.514	9.926	63.020	10.761	65.512	11.633	67.988	12.542	70.446	13.487	72.885	14.466	75.304	15.478	77.701	16.522	80.076	17.596	82.426	18.699	84.752	19.831	45	35 (F)*
40	53.790	8.823	56.296	9.660	58.785	10.540	61.253	11.460	63.709	12.420	66.152	13.417	68.577	14.451	70.986	15.520	73.268	16.622	75.992	17.755							40	30 (H)**
35	52.056	9.449	54.519	10.383	56.954	11.362	59.371	12.383	61.753	13.445	64.109	14.544															35	
33	51.333	9.763	53.772	10.742	56.184	11.765	58.565	12.831	60.913	13.937																	33	30 (F)*
30	50.202	10.319	52.594	11.370	54.951	12.466																					30	30 (H)**
25																											25	
23																											23	25 (F)*
20																											20	25 (H)**
15																											15	20 (F)*
14																											14	20 (H)**

*F = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 37°$

Deviation Angle = 37 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	843.989	136.234	846.490	136.237	848.991	136.241	851.493	136.246	853.995	136.252	856.497	136.258	858.999	136.266	861.502	136.274	864.005	136.283	866.508	136.293	869.011	136.304	871.515	136.316	874.019	136.329	2500	
2200	743.611	119.887	746.112	119.890	748.613	119.895	751.115	119.900	753.617	119.907	756.119	119.914	758.622	119.923	761.125	119.932	763.628	119.943	766.132	119.954	768.636	119.967	771.140	119.980	773.645	119.995	2200	
2000	676.692	108.989	679.193	108.993	681.695	108.998	684.197	109.004	686.699	109.011	689.201	109.019	691.704	109.029	694.208	109.039	696.711	109.050	699.215	109.063	701.719	109.077	704.224	109.092	706.729	109.108	2000	
1800	609.773	98.091	612.274	98.095	614.776	98.101	617.278	98.107	619.781	98.115	622.283	98.125	624.787	98.135	627.290	98.147	629.794	98.159	632.299	98.173	634.804	98.189	637.309	98.205	639.814	98.223	1800	
1500	509.395	81.745	511.896	81.750	514.398	81.756	516.901	81.764	519.404	81.774	521.907	81.785	524.411	81.797	526.916	81.811	529.420	81.827	531.926	81.844	534.431	81.862	536.938	81.882	539.444	81.903	1500	
1200	409.017	65.399	411.519	65.405	414.021	65.413	416.525	65.423	419.028	65.435	421.532	65.449	424.037	65.465	426.543	65.482	429.049	65.501	431.555	65.522	434.062	65.545	436.570	65.570	439.078	65.596	1200	
1000	342.098	54.502	344.601	54.510	347.104	54.520	349.608	54.532	352.112	54.546	354.617	54.562	357.123	54.581	359.629	54.602	362.136	54.625	364.644	54.650	367.153	54.678	369.662	54.707	372.172	54.739	1000	
900	308.639	49.054	311.142	49.062	313.645	49.073	316.149	49.087	318.654	49.103	321.160	49.121	323.667	49.142	326.174	49.165	328.682	49.191	331.190	49.219	333.699	49.249	336.210	49.282	338.720	49.317	900	
800	275.180	43.606	277.683	43.615	280.187	43.628	282.691	43.643	285.197	43.661	287.703	43.681	290.211	43.705	292.719	43.731	295.228	43.760	297.737	43.791	300.248	43.825	302.759	43.863	305.271	43.903	800	
700	241.721	38.158	244.225	38.170	246.729	38.184	249.234	38.201	251.741	38.221	254.248	38.245	256.756	38.271	259.265	38.301	261.775	38.334	264.286	38.370	266.798	38.410	269.311	38.452	271.825	38.497	700	100 (P)*
600	208.262	32.712	210.766	32.725	213.271	32.741	215.778	32.761	218.285	32.785	220.793	32.812	223.303	32.844	225.814	32.878	228.325	32.917	230.838	32.959	233.352	33.005	235.867	33.054	238.383	33.107	600	
500	174.804	27.266	177.309	27.281	179.815	27.301	182.322	27.325	184.831	27.354	187.341	27.386	189.852	27.424	192.365	27.466	194.879	27.512	197.394	27.563	199.911	27.617	202.428	27.677	204.947	27.740	500	
480	141.346	21.822	143.852	21.841	146.359	21.865	148.869	21.896	151.380	21.931	153.892	21.973	156.406	22.019	158.922	22.072	161.439	22.129	163.958	22.192	166.478	22.261	169.000	22.335	171.523	22.414	480	
360	127.963	19.645	130.469	19.666	132.978	19.693	135.488	19.727	138.000	19.767	140.514	19.812	143.030	19.864	145.547	19.922	148.066	19.986	150.587	20.056	153.109	20.133	155.633	20.215	158.158	20.303	360	
300	124.617	19.101	127.124	19.122	129.633	19.151	132.143	19.185	134.656	19.226	137.170	19.273	139.686	19.326	142.204	19.386	144.723	19.452	147.244	19.524	149.767	19.603	152.292	19.687	154.818	19.778	300	80 (P)*
250	107.889	16.381	110.397	16.406	112.907	16.439	115.419	16.479	117.933	16.527	120.450	16.582	122.968	16.644	125.489	16.714	128.011	16.790	130.536	16.875	133.062	16.966	135.590	17.065	138.120	17.171	250	
230	91.161	13.663	93.671	13.693	96.183	13.733	98.697	13.781	101.214	13.838	103.734	13.904	106.256	13.979	108.780	14.062	111.306	14.154	113.835	14.255	116.366	14.365	118.899	14.484	121.434	14.611	230	
200	84.470	12.576	86.980	12.610	89.494	12.653	92.009	12.705	94.528	12.767	97.049	12.839	99.572	12.920	102.098	13.011	104.627	13.111	107.158	13.220	109.691	13.340	112.227	13.468	114.764	13.607	200	
170	74.434	10.948	76.946	10.986	79.461	11.036	81.979	11.096	84.500	11.167	87.024	11.250	89.551	11.343	92.080	11.447	94.612	11.563	97.147	11.689	99.685	11.826	102.225	11.974	104.767	12.133	170	65 (P)*
150	64.399	9.322	66.913	9.367	69.430	9.425	71.951	9.496	74.475	9.580	77.003	9.677	79.534	9.787	82.068	9.909	84.605	10.045	87.145	10.193	89.688	10.354	92.233	10.528	94.781	10.715	150	
135	59.382	8.510	61.897	8.560	64.416	8.623	66.938	8.701	69.465	8.793	71.995	8.900	74.528	9.020	77.065	9.154	79.605	9.303	82.148	9.465	84.694	9.642	87.243	9.833	89.794	10.037	135	
125	52.342	6.891	54.867	6.952	57.392	7.031	59.918	7.128	62.445	7.242	64.973	7.373	67.503	7.522	70.033	7.689	72.564	7.873	75.096	8.074	77.628	8.293	80.162	8.529	82.696	8.782	125	
100	40.989	5.548	43.512	5.625	46.040	5.724	48.574	5.844	51.112	5.987	53.656	6.151	56.203	6.337	58.755	6.545	61.311	6.775	63.870	7.026	66.432	7.299	68.997	7.593	71.565	7.908	100	50 (P)*
90	37.647	5.014	40.171	5.099	42.702	5.209	45.239	5.343	47.781	5.501	50.328	5.684	52.880	5.891	55.436	6.121	57.995	6.376	60.558	6.655	63.124	6.957	65.693	7.284	68.264	7.633	90	
80	34.305	4.483	36.832	4.579	39.366	4.702	41.907	4.853	44.453	5.031	47.004	5.236	49.560	5.468	52.121	5.728	54.685	6.014	57.252	6.327	59.822	6.666	62.394	7.032	64.967	7.423	80	50 (H)**
70	30.964	3.956	33.494	4.065	36.033	4.206	38.578	4.378	41.129	4.582	43.685	4.816	46.246	5.081	48.811	5.376	51.380	5.703	53.951	6.059	56.525	6.446	59.099	6.863	61.675	7.309	70	
60	27.624	3.434	30.159	3.562	32.703	3.726	35.253	3.927	37.810	4.164	40.372	4.437	42.939	4.745	45.509	5.089	48.082	5.468	50.656	5.882	53.232	6.331	55.807	6.814	58.382	7.332	60	40 (P)*
55	25.955	3.177	28.493	3.316	31.039	3.495	33.593	3.714	36.153	3.972	38.719	4.269	41.288	4.605	43.861	4.980	46.435	5.392	49.011	5.843	51.586	6.330	54.160	6.855	56.731	7.417	55	
50	24.287	2.922	26.828	3.076	29.378	3.273	31.935	3.513	34.499	3.796	37.067	4.123	39.639	4.491	42.214	4.902	44.789	5.354	47.364	5.848	49.938	6.382	52.508	6.956	55.075	7.569	50	40 (H)**
45	22.619	2.672	25.164	2.842	27.718	3.061	30.279	3.327	32.846	3.642	35.418	4.003	37.992	4.412	40.568	4.866	43.145	5.367	45.726	5.917	48.285	6.507	50.849	7.134	53.395	7.810	45	35 (P)*
40	20.953	2.427	23.502	2.618	26.060	2.864	28.626	3.163	31.197	3.516	33.771	3.922	36.346	4.379	38.921	4.888	41.493	5.447	44.060	6.056	46.620	6.713	49.171	7.417	51.712	8.168	40	35 (H) 30 (P)*
35	19.289	2.189	21.843	2.408	24.406	2.688	26.976	3.030	29.550	3.431	32.125	3.893	34.699	4.412	37.270	4.989	39.833	5.622	42.388	6.310	44.931	7.051	47.460	7.843	49.972	8.686	35	
33	18.624	2.097	21.180	2.329	23.745	2.626	26.316	2.988	28.891	3.413	31.466	3.901	34.039	4.450	36.605	5.059	39.164	5.727	41.711	6.452	44.243	7.233	46.758	8.066	49.254	8.951	33	
30	17.627	1.964	20.186	2.218	22.755	2.544	25.328	2.941	27.904	3.407	30.477	3.941	33.045	4.542	35.604	5.207	38.150	5.934	40.680	6.723	43.190	7.570	45.678	8.472	48.140	9.428	30	30 (H)**
25	15.960	1.756	18.533	2.061	21.107	2.451	23.682	2.924	26.254	3.479	28.818	4.111	31.366	4.820	33.900	5.602	36.408	6.455	38.889	7.374	41.336	8.355	43.748	9.396	46.118	10.491	25	
23	15.305	1.682	17.874	2.012	20.449	2.435	23.023	2.947	25.591	3.546	28.146	4.229	30.683	4.992	33.196	5.833	35.679	6.746	38.127	7.727	40.535	8.773	42.897	9.872			23	25 (P)*
20	14.313	1.582	16.895	1.961	19.461	2.444	22.030	3.028	24.596	3.709	27.120	4.482	29.625	5.343	32.093	6.385	34.519	7.304	36.894	8.392							20	25 (H)**
15	12.664	1.471	15.239	1.871	17.802	2.603	20.340	3.361	22.859	4.236	25.367	5.217	27.871	6.294													15	20 (P)*
14	12.335	1.462	14.868	1.906	17.464	2.669	19.989	3.474	22.465	4.409	24.980	5.434															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 37 Degrees

$\Delta = 37°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	876.523	136.343	879.028	136.357	881.532	136.372	884.038	136.389	886.543	136.406	889.049	136.424	891.554	136.443	894.061	136.462	896.567	136.483	899.074	136.505	901.581	136.527	904.088	136.550	906.595	136.574	2500	
2200	776.149	120.010	778.655	120.027	781.160	120.044	783.666	120.063	786.172	120.082	788.678	120.103	791.185	120.124	793.692	120.146	796.199	120.170	798.707	120.194	801.214	120.220	803.722	120.246	806.231	120.274	2200	
2000	709.234	109.125	711.740	109.143	714.246	109.162	716.752	109.182	719.259	109.204	721.766	109.226	724.273	109.250	726.781	109.274	729.289	109.300	731.797	109.327	734.306	109.355	736.815	109.384	739.324	109.415	2000	
1800	642.320	98.242	644.826	98.262	647.333	98.283	649.840	98.306	652.347	98.330	654.855	98.355	657.363	98.381	659.872	98.408	662.380	98.437	664.890	98.467	667.399	98.498	669.909	98.531	672.419	98.564	1800	
1500	541.951	81.925	544.458	81.950	546.967	81.975	549.475	82.002	551.984	82.031	554.493	82.061	557.003	82.093	559.513	82.125	562.023	82.160	564.534	82.196	567.046	82.233	569.557	82.272	572.070	82.312	1500	
1200	441.587	65.625	444.096	65.655	446.606	65.687	449.116	65.721	451.627	65.757	454.139	65.794	456.651	65.833	459.163	65.875	461.677	65.918	464.190	65.962	466.704	66.009	469.219	66.058	471.734	66.108	1200	
1000	374.682	54.773	377.193	54.809	379.705	54.848	382.217	54.888	384.730	54.931	387.244	54.976	389.758	55.024	392.275	55.073	394.789	55.125	397.305	55.178	399.822	55.234	402.339	55.293	404.857	55.353	1000	
900	341.232	49.355	343.744	49.396	346.257	49.438	348.771	49.483	351.285	49.531	353.801	49.581	356.316	49.633	358.833	49.688	361.350	49.746	363.867	49.805	366.386	49.868	368.905	49.932	371.425	50.000	900	
800	307.784	43.945	310.298	43.990	312.813	44.039	315.328	44.089	317.844	44.143	320.361	44.199	322.878	44.258	325.396	44.320	327.916	44.384	330.436	44.452	332.956	44.521	335.478	44.594	338.000	44.670	800	
700	274.340	38.546	276.855	38.598	279.372	38.653	281.889	38.711	284.407	38.772	286.926	38.836	289.446	38.904	291.967	38.974	294.489	39.048	297.011	39.125	299.534	39.205	302.059	39.288	304.583	39.374	700	
600	240.900	33.164	243.415	33.224	245.937	33.288	248.457	33.356	250.978	33.427	253.500	33.502	256.023	33.581	258.547	33.663	261.072	33.750	263.597	33.839	266.124	33.932	268.652	34.029	271.180	34.130	600	
500	207.467	27.808	209.989	27.881	212.511	27.958	215.035	28.039	217.560	28.125	220.086	28.215	222.613	28.309	225.141	28.407	227.670	28.511	230.200	28.618	232.732	28.730	235.264	28.846	237.798	28.967	500	
400	174.048	22.500	176.574	22.590	179.101	22.686	181.630	22.788	184.160	22.895	186.692	23.007	189.225	23.125	191.759	23.249	194.295	23.377	196.831	23.512	199.369	23.651	201.909	23.797	204.449	23.948	400	
360	160.686	20.398	163.214	20.498	165.744	20.605	168.276	20.718	170.809	20.837	173.344	20.962	175.880	21.093	178.417	21.230	180.956	21.373	183.496	21.522	186.037	21.677	188.580	21.839	191.124	22.006	360	100 (P)*
350	157.346	19.875	159.875	19.979	162.406	20.088	164.938	20.204	167.472	20.327	170.008	20.455	172.545	20.590	175.083	20.731	177.623	20.878	180.164	21.031	182.706	21.191	185.250	21.357	187.795	21.529	350	
300	140.652	17.284	143.186	17.405	145.721	17.533	148.258	17.668	150.796	17.811	153.337	17.960	155.879	18.117	158.422	18.282	160.967	18.454	163.513	18.632	166.061	18.819	168.610	19.012	171.161	19.213	300	
250	123.971	14.747	126.510	14.891	129.051	15.045	131.594	15.207	134.139	15.378	136.686	15.558	139.234	15.746	141.784	15.943	144.335	16.149	146.888	16.363	149.443	16.586	151.999	16.818	154.556	17.058	250	
230	117.304	13.754	119.846	13.912	122.390	14.078	124.936	14.255	127.483	14.440	130.033	14.635	132.584	14.840	135.137	15.054	137.692	15.277	140.248	15.510	142.806	15.752	145.365	16.004	147.925	16.265	230	80 (P)*
200	107.311	12.302	109.858	12.483	112.407	12.673	114.958	12.877	117.511	13.090	120.065	13.314	122.622	13.549	125.180	13.795	127.740	14.052	130.302	14.319	132.864	14.597	135.429	14.886	137.994	15.185	200	
170	97.331	10.914	99.884	11.127	102.439	11.352	104.996	11.590	107.555	11.840	110.116	12.103	112.678	12.379	115.243	12.668	117.809	12.969	120.376	13.283	122.944	13.609	125.514	13.948	128.085	14.299	170	
155	92.348	10.256	94.904	10.489	97.462	10.735	100.023	10.996	102.585	11.270	105.150	11.559	107.716	11.861	110.283	12.177	112.852	12.506	115.422	12.850	117.994	13.207	120.566	13.578	123.139	13.962	155	65 (P)*
125	82.399	9.053	84.964	9.341	87.530	9.645	90.098	9.967	92.668	10.306	95.239	10.662	97.812	11.035	100.385	11.425	102.959	11.832	105.534	12.255	108.110	12.695	110.685	13.151	113.261	13.624	125	
100	74.134	8.245	76.706	8.603	79.279	8.982	81.853	9.383	84.427	9.804	87.003	10.246	89.578	10.709	92.154	11.192	94.729	11.695	97.303	12.219	99.876	12.764	102.447	13.328	105.017	13.912	100	
90	70.856	8.007	73.410	8.303	75.985	8.824	78.560	9.267	81.136	9.733	83.711	10.222	86.285	10.733	88.859	11.267	91.431	11.824	94.001	12.402	96.569	13.003	99.135	13.625	101.697	14.269	90	50 (P)
80	67.542	7.843	70.117	8.288	72.693	8.758	75.268	9.254	77.842	9.776	80.415	10.322	82.986	10.894	85.554	11.490	88.120	12.111	90.682	12.756	93.240	13.425	95.794	14.118	98.342	14.834	80	50 (H)**
70	64.250	7.785	66.825	8.290	69.398	8.824	71.970	9.387	74.539	9.978	77.105	10.597	79.667	11.244	82.224	11.918	84.776	12.619	87.322	13.347	89.862	14.101	92.394	14.881	94.919	15.687	70	40 (P)*
60	60.954	7.882	63.524	8.466	66.090	9.083	68.651	9.732	71.207	10.413	73.757	11.126	76.299	11.869	78.834	12.642	81.359	13.446	83.875	14.278	86.380	15.139	88.874	16.028	91.356	16.944	60	
55	59.300	8.014	61.864	8.647	64.422	9.315	66.974	10.018	69.518	10.754	72.053	11.523	74.579	12.325	77.095	13.159	79.599	14.024	82.090	14.919	84.568	15.844	87.031	16.798	89.479	17.779	55	
50	57.636	8.222	60.190	8.912	62.736	9.640	65.273	10.404	67.799	11.205	70.314	12.040	72.816	12.910	75.304	13.812	77.777	14.747	80.234	15.714	82.673	16.710	85.094	17.737	87.495	18.791	50	40 (H)**
45	55.954	8.528	58.492	9.286	61.019	10.084	63.534	10.921	66.033	11.797	68.517	12.708	70.984	13.656	73.432	14.637	75.860	15.652	78.267	16.699	80.652	17.776	83.013	18.883	85.349	20.018	45	35 (P)*
40	54.240	8.964	56.753	9.803	59.250	10.685	61.728	11.608	64.187	12.571	66.624	13.571	69.038	14.608	71.427	15.680	73.789	16.785	76.123	17.921							40	30 (H)**
35	52.463	9.577	54.936	10.514	57.384	11.496	59.807	12.520	62.201	13.584	64.565	14.687															35	
33	51.727	9.886	54.175	10.868	56.596	11.894	58.986	12.963	61.345	14.072																	33	30 (P)*
30	50.573	10.433	52.975	11.489	55.342	12.589																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 38 Degrees

$\Delta = 38°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	868.320	144.056	870.821	144.060	873.322	144.064	875.823	144.068	878.325	144.074	880.827	144.081	883.330	144.088	885.833	144.097	888.336	144.106	890.839	144.116	893.342	144.127	895.846	144.139	898.350	144.152	2500	
2200	765.021	126.771	767.523	126.774	770.024	126.779	772.526	126.784	775.028	126.791	779.531	126.798	780.033	126.807	782.536	126.816	785.040	126.827	787.543	126.838	790.047	126.851	792.552	126.864	795.057	126.879	2200	
2000	696.156	115.247	698.657	115.251	701.159	115.256	703.661	115.262	706.164	115.269	708.666	115.277	711.169	115.287	713.673	115.297	716.176	115.309	718.680	115.321	721.185	115.335	723.689	115.350	726.195	115.366	2000	
1800	627.291	103.723	629.792	103.728	632.294	103.733	634.796	103.740	637.299	103.748	639.802	103.757	642.305	103.767	644.809	103.779	647.313	103.792	649.818	103.806	652.323	103.821	654.828	103.838	657.333	103.855	1800	
1500	523.993	86.438	526.495	86.443	528.997	86.450	531.500	86.458	534.003	86.467	536.506	86.479	539.010	86.491	541.515	86.505	544.020	86.520	546.525	86.537	549.031	86.556	551.537	86.576	554.044	86.597	1500	
1200	420.696	69.154	423.198	69.160	425.700	69.168	428.204	69.178	430.708	69.190	433.212	69.204	435.717	69.219	438.222	69.237	440.729	69.256	443.235	69.277	445.743	69.300	448.250	69.325	450.759	69.352	1200	
1000	351.831	57.631	354.333	57.639	356.836	57.649	359.340	57.661	361.845	57.675	364.350	57.691	366.856	57.710	369.363	57.731	371.870	57.754	374.378	57.780	376.887	57.807	379.396	57.837	381.906	57.869	1000	
900	317.398	51.870	319.901	51.878	322.405	51.890	324.909	51.903	327.414	51.919	329.920	51.937	332.426	51.958	334.934	51.981	337.442	52.007	339.951	52.035	342.460	52.066	344.971	52.099	347.482	52.135	900	
800	282.966	46.109	285.469	46.119	287.973	46.131	290.478	46.146	292.984	46.164	295.490	46.185	297.998	46.208	300.506	46.234	303.015	46.263	305.525	46.295	308.036	46.329	310.548	46.367	313.060	46.407	800	
700	248.534	40.349	251.037	40.360	253.542	40.374	256.047	40.391	258.554	40.412	261.061	40.435	263.570	40.462	266.079	40.492	268.590	40.525	271.101	40.562	273.613	40.601	276.127	40.643	278.641	40.689	700	100 (P)*
600	214.102	34.589	216.606	34.602	219.111	34.619	221.618	34.639	224.125	34.662	226.634	34.690	229.144	34.721	231.655	34.756	234.167	34.795	236.680	34.837	239.194	34.883	241.710	34.933	244.226	34.986	600	
500	179.670	28.830	182.175	28.846	184.681	28.865	187.189	28.890	189.698	28.918	192.208	28.951	194.720	28.989	197.233	29.031	199.748	29.077	202.263	29.128	204.780	29.183	207.298	29.242	209.818	29.306	500	
400	145.239	23.073	147.745	23.093	150.253	23.117	152.763	23.147	155.274	23.183	157.787	23.225	160.301	23.271	162.817	23.324	165.335	23.382	167.854	23.445	170.375	23.514	172.898	23.588	175.422	23.668	400	
360	131.467	20.771	133.974	20.793	136.482	20.820	138.993	20.854	141.505	20.894	144.020	20.939	146.536	20.991	149.053	21.050	151.573	21.114	154.094	21.184	156.617	21.260	159.142	21.343	161.668	21.432	360	
320	122.024	20.196	130.531	20.218	133.040	20.246	135.551	20.281	138.063	20.322	140.578	20.369	143.094	20.422	145.613	20.482	148.133	20.548	150.655	20.621	153.178	20.699	155.704	20.784	158.231	20.875	320	
300	110.809	17.319	113.317	17.345	115.827	17.378	118.340	17.418	120.855	17.466	123.372	17.521	125.891	17.584	128.412	17.654	130.935	17.730	133.460	17.815	135.987	17.907	138.517	18.006	141.048	18.112	300	80 (P)*
250	93.593	14.445	96.104	14.476	98.617	14.515	101.132	14.564	103.649	14.621	106.169	14.687	108.692	14.762	111.217	14.846	113.744	14.938	116.274	15.040	118.806	15.149	121.340	15.268	123.876	15.396	250	
230	86.709	13.296*	89.220	13.329	91.733	13.373	94.249	13.425	96.768	13.487	99.290	13.559	101.814	13.641	104.341	13.732	106.871	13.832	109.403	13.942	111.937	14.062	114.474	14.191	117.013	14.330	230	
200	76.381	11.574	78.893	11.612	81.409	11.662	83.927	11.722	86.449	11.794	88.974	11.877	91.501	11.970	94.032	12.075	96.565	12.190	99.101	12.317	101.640	12.454	104.181	12.603	106.725	12.762	200	
170	66.054	9.854	68.568	9.899	71.086	9.958	73.608	10.029	76.133	10.113	78.661	10.210	81.193	10.320	83.728	10.443	86.267	10.579	88.808	10.728	91.352	10.889	93.899	11.064	96.449	11.251	170	65 (P)*
155	60.191	8.995	63.406	9.045	65.926	9.109	68.449	9.187	70.977	9.279	73.508	9.386	76.042	9.507	78.580	9.641	81.122	9.790	83.666	9.953	86.214	10.131	88.764	10.322	91.317	10.527	155	
125	49.566	7.282	52.085	7.344	55.608	7.423	58.137	7.520	60.670	7.634	63.207	7.766	65.749	7.916	68.294	8.083	70.843	8.267	73.396	8.469	75.952	8.689	78.510	8.925	81.072*	9.179	125	
100	41.964	5.861	44.487	5.938	47.016	6.037	49.551	6.158	52.090	6.301	54.635	6.466	57.185	6.653	59.739	6.861	62.296	7.092	64.858	7.343	67.423	7.617	69.990	7.912	72.561	8.228	100	
90	38.524	5.296	41.049	5.382	43.581	5.492	46.119	5.626	48.662	5.785	51.211	5.968	53.765	6.175	56.323	6.407	58.885	6.662	61.450	6.942	64.019	7.245	66.591	7.572	69.165	7.923	90	50 (P)*
80	35.084	4.734	37.613	4.830	40.145	4.954	42.690	5.105	45.238	5.283	47.791	5.489	50.349	5.722	52.912	5.982	55.478	6.269	58.048	6.583	60.621	6.923	63.197	7.290	65.774	7.684	80	50 (H)**
70	31.646	4.175	34.178	4.285	36.718	4.426	39.264	4.599	41.817	4.803	44.376	5.038	46.939	5.304	49.507	5.600	52.079	5.927	54.653	6.285	57.230	6.673	59.809	7.091	62.388	7.539	70	
60	28.210	3.622	30.746	3.751	33.291	3.916	35.843	4.117	38.402	4.354	40.967	4.628	43.536	4.937	46.110	5.282	48.686	5.662	51.265	6.078	53.844	6.528	56.424	7.013	59.003	7.531	60	40 (P)*
55	26.492	3.349	29.031	3.489	31.579	3.669	34.135	3.888	36.698	4.147	39.266	4.445	41.838	4.782	44.414	5.158	46.992	5.571	49.572	6.023	52.152	6.512	54.731	7.039	57.308	7.602	55	
50	24.772	3.079	27.318	3.233	29.869	3.431	32.429	3.672	34.995	3.956	37.567	4.283	40.142	4.653	42.720	5.065	45.300	5.519	47.880	6.011	50.458	6.549	53.036	7.125	55.606	7.740	50	40 (H)**
45	23.099	2.813	25.606	2.984	28.161	3.203	30.725	3.471	33.295	3.786	35.870	4.149	38.446	4.558	41.028	5.014	43.608	5.516	46.193	6.067	48.780	6.664	51.366	7.308	53.953	7.967	45	35 (P)**
40	21.345	2.552	23.893	2.745	26.456	2.991	29.024	3.291	31.598	3.645	34.176	4.052	36.756	4.511	39.335	5.021	41.912	5.582	44.485	6.192	47.051	6.851	49.609	7.558	52.156	8.311	40	35 (H) 30 (P)*
35	19.632	2.300	22.188	2.519	24.754	2.800	27.327	3.142	29.904	3.545	32.484	4.008	35.063	4.529	37.639	5.108	40.208	5.743	42.769	6.432	45.319	7.175	47.865	7.970	50.375	8.816	35	
33	18.948	2.201	21.506	2.434	24.074	2.732	26.648	3.095	29.227	3.521	31.807	4.010	34.385	4.561	36.957	5.172	39.521	5.842	42.075	6.569	44.614	7.352	47.137	8.188	49.641	9.076	33	
30	17.922	2.058	20.483	2.314	23.055	2.641	25.632	3.039	28.212	3.506	30.790	4.045	33.364	4.644	35.929	5.311	38.481	6.041	41.019	6.832	43.537	7.681	46.033	8.586	48.504	9.545	30	30 (H)**
25	16.214	1.856	18.783	2.142	21.360	2.532	23.940	3.007	26.517	3.562	29.087	4.197	31.643	4.908	34.182	5.693	36.698	6.548	39.187	7.470	41.644	8.454	44.065	9.498	46.446	10.596	25	
23	15.533	1.755	18.105	2.087	20.683	2.510	23.262	3.024	25.836	3.624	28.397	4.309	30.941	5.075	33.462	5.918	35.953	6.834	38.410	7.818	40.828	8.867	43.201	9.974			23	25 (P)*
20	14.512	1.646	17.088	2.026	19.668	2.510	22.242	3.096	24.804	3.779	27.346	4.555	29.859	5.418	32.336	6.363	34.771	7.385	37.156	8.477							20	25 (H)**
15	12.816	1.519	15.395	2.021	17.964	2.656	20.509	3.416	23.017	4.293	25.473	5.277	27.867	6.358													15	20 (P)*
14	12.478	1.508	13.055	2.043	17.618	2.719	20.150	3.526	22.635	4.454	25.060	5.491															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

$\Delta = 38°$

TABLE 16 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 38 Degrees

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	900.855	144.165	903.359	144.180	905.864	144.195	908.370	144.212	910.875	144.229	913.381	144.247	915.887	144.266	918.393	144.286	920.900	144.306	923.407	144.328	925.914	144.351	928.421	144.374	930.929	144.398	2500	
2100	797.561	126.894	800.067	126.911	802.572	126.928	805.078	126.947	807.585	126.967	810.091	126.987	812.598	127.009	815.105	127.031	817.613	127.055	820.120	127.079	822.628	127.105	825.137	127.131	827.646	127.159	2100	
2000	728.700	115.383	731.206	115.401	733.712	115.420	736.219	115.441	738.725	115.462	741.233	115.485	743.740	115.509	746.248	115.533	748.756	115.559	751.265	115.586	753.774	115.614	756.283	115.644	758.792	115.674	2000	
1800	659.840	103.875	662.346	103.895	664.853	103.916	667.360	103.939	669.868	103.963	672.375	103.988	674.884	104.014	677.393	104.042	679.902	104.070	682.411	104.100	684.921	104.131	687.431	104.164	689.942	104.198	1800	
1500	556.551	86.619	559.059	86.644	561.567	86.670	564.076	86.697	566.585	86.725	569.094	86.755	571.604	86.787	574.115	86.820	576.725	86.854	579.137	86.891	581.648	86.928	584.161	86.967	586.673	87.007	1500	
1200	453.268	69.380	455.778	69.411	458.287	69.443	460.798	69.477	463.309	69.512	465.821	69.550	468.333	69.590	470.846	69.631	473.360	69.674	475.874	69.719	478.388	69.766	480.904	69.814	483.419	69.865	1200	
1000	384.417	57.903	386.928	57.939	389.441	57.978	391.953	58.019	394.467	58.062	396.980	58.107	399.495	58.154	402.011	58.204	404.527	58.255	407.043	58.309	409.561	58.366	412.079	58.424	414.597	58.484	1000	
900	349.994	52.172	352.507	52.213	355.020	52.256	357.534	52.301	360.049	52.348	362.564	52.398	365.081	52.451	367.598	52.506	370.115	52.564	372.634	52.624	375.153	52.686	377.672	52.751	380.193	52.818	900	
800	315.573	46.449	318.087	46.495	320.603	46.543	323.118	46.594	325.635	46.647	328.152	46.704	330.670	46.763	333.189	46.825	335.709	46.890	338.229	46.958	340.750	47.027	343.272	47.100	345.795	47.176	800	
700	281.156	40.738	283.672	40.789	286.189	40.845	288.707	40.903	291.226	40.964	293.745	41.029	296.266	41.096	298.787	41.167	301.310	41.241	303.833	41.318	306.357	41.398	308.882	41.482	311.407	41.568	700	
600	246.743	35.042	249.262	35.103	251.782	35.167	254.302	35.235	256.824	35.307	259.346	35.382	261.870	35.461	264.395	35.544	266.921	35.630	269.447	35.720	271.975	35.813	274.504	35.911	277.033	36.011	600	
500	212.339	29.375	214.861	29.447	217.384	29.524	219.908	29.606	222.434	29.691	224.961	29.782	227.489	29.876	230.018	29.976	232.548	30.079	235.079	30.187	237.612	30.299	240.145	30.416	242.680	30.537	500	
400	177.947	23.753	180.474	23.844	183.002	23.940	185.532	24.042	188.063	24.149	190.596	24.262	193.130	24.381	195.665	24.504	198.202	24.634	200.740	24.768	203.279	24.908	205.820	25.054	208.362	25.206	400	
360	164.196	21.527	166.726	21.627	169.257	21.735	171.790	21.848	174.324	21.967	176.860	22.092	179.397	22.224	181.936	22.361	184.476	22.505	187.017	22.654	189.560	22.810	192.104	22.972	194.650	23.139	360	100 (P)*
350	160.759	20.973	163.290	21.076	165.822	21.187	168.355	21.303	170.890	21.426	173.427	21.554	175.965	21.689	178.505	21.831	181.045	21.979	183.588	22.132	186.132	22.293	188.677	22.459	191.224	22.632	350	
300	143.580	18.226	146.115	18.347	148.652	18.475	151.190	18.611	153.730	18.754	156.271	18.904	158.815	19.062	161.360	19.227	163.906	19.398	166.454	19.578	169.003	19.765	171.554	19.958	174.107	20.160	300	
250	126.415	15.532	128.955	15.677	131.498	15.831	134.042	15.994	136.588	16.166	139.136	16.345	141.686	16.534	144.238	16.732	146.792	16.938	149.347	17.153	151.903	17.377	154.461	17.609	157.021	17.851	250	
230	119.534	14.478	122.097	14.635	124.643	14.803	127.190	14.979	129.739	15.166	132.291	15.361	134.844	15.566	137.399	15.781	139.956	16.005	142.514	16.239	145.074	16.482	147.635	16.734	150.196	16.996	230	80 (P)*
200	109.271	12.932	111.819	13.114	114.370	13.306	116.922	13.509	119.477	13.723	122.034	13.947	124.593	14.183	127.153	14.430	129.716	14.687	132.280	14.955	134.845	15.234	137.412	15.524	129.980	15.824	200	
170	90.001	11.451	101.556	11.664	104.113	11.890	106.672	12.129	109.233	12.380	111.796	12.644	114.362	12.920	116.929	13.210	119.497	13.512	122.067	13.826	124.639	14.154	127.212	14.493	129.786	14.846	170	
155	83.873	10.746	96.431	10.980	98.992	11.227	101.555	11.489	104.120	11.764	106.687	12.053	109.256	12.356	111.826	12.673	114.398	13.003	116.971	13.348	119.546	13.706	122.122	14.078	124.699	14.463	155	65 (P)*
125	83.637	9.451	86.204	9.739	88.773	10.045	91.344	10.368	93.917	10.708	96.491	11.065	99.067	11.439	101.644	11.830	104.222	12.238	106.801	12.662	109.381	13.103	111.960	13.561	114.540	14.036	125	
100	75.133	8.566	77.708	8.926	80.284	9.306	82.862	9.707	85.441	10.130	88.020	10.573	90.600	11.037	93.180	11.522	95.759	12.027	98.338	12.552	100.916	13.098	103.493	13.664	106.068	14.250	100	
90	71.741	8.298	74.318	8.605	76.897	9.117	79.476	9.561	82.056	10.029	84.636	10.519	87.215	11.032	89.794	11.568	92.371	12.126	94.946	12.706	97.520	13.308	100.091	13.932	102.659	14.578	90	50 (P)
80	68.353	8.104	70.932	8.350	73.512	9.021	76.092	9.319	78.671	10.042	81.249	10.590	83.825	11.164	86.399	11.762	88.970	12.384	91.538	13.031	94.102	13.703	96.662	14.397	99.218	15.116	80	50 (H)**
70	64.968	8.016	67.547	8.522	70.126	9.058	72.703	9.623	75.277	10.215	77.849	10.836	80.416	11.485	82.980	12.161	85.538	12.865	88.091	13.595	90.638	14.351	93.178	15.133	95.710	15.941	70	
60	61.381	8.084	64.156	8.670	66.727	9.288	69.295	9.939	71.857	10.622	74.413	11.337	76.963	12.082	79.504	12.858	82.037	13.664	84.561	14.499	87.074	15.362	89.576	16.254	92.066	17.173	60	40 (P)*
55	59.881	8.201	62.451	8.836	65.015	9.506	67.574	10.211	70.125	10.949	72.667	11.721	75.201	12.525	77.724	13.361	80.236	14.229	82.735	15.127	85.221	16.054	87.694	17.011	90.151	17.995	55	
50	58.173	8.395	60.734	9.087	63.286	9.817	65.830	10.584	68.364	11.386	70.887	12.224	73.397	13.096	75.893	14.002	78.375	14.939	80.840	15.909	83.289	16.908	85.719	17.938	88.130	18.995	50	40 (H)**
45	56.448	8.686	58.993	9.447	61.528	10.248	64.050	11.087	66.558	11.965	69.050	12.880	71.525	13.830	73.982	14.814	76.420	15.832	78.837	16.882	81.231	17.963	83.602	19.073	85.949	20.211	45	35 (P)*
40	54.691	9.109	57.212	9.931	59.717	10.836	62.205	11.762	64.672	12.727	67.118	13.730	69.542	14.770	71.940	15.845	74.313	16.953	76.658	18.093							40	30 (H)**
35	52.876	9.709	55.357	10.649	57.814	11.634	60.245	12.661	62.649	13.728	65.024	14.834															35	
33	52.123	10.013	54.580	10.998	57.010	12.027	59.410	13.100	61.779	14.212																	33	30 (P)*
30	50.947	10.555	53.358	11.612	55.735	12.715																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 39 Degrees

$\Delta = 39°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	892.797	152.125	893.298	152.128	893.799	152.132	900.301	152.136	902.803	152.142	905.305	152.149	907.808	152.156	910.311	152.165	912.814	152.174	915.317	152.184	917.820	152.195	920.324	152.207	922.829	152.220	2500	
2200	786.502	133.871	789.063	133.874	791.564	133.879	794.066	133.884	796.568	133.891	799.071	133.898	801.574	133.907	804.077	133.916	806.580	133.927	809.084	133.938	811.588	133.951	814.093	133.965	816.598	133.979	2200	
2000	713.738	121.701	718.240	121.705	720.741	121.710	723.243	121.716	725.745	121.724	728.249	121.732	730.751	121.741	733.255	121.752	735.759	121.763	738.263	121.776	740.768	121.790	743.272	121.805	745.778	121.821	2000	
1800	644.915	109.332	647.416	109.337	649.918	109.342	652.420	109.349	654.923	109.357	657.426	109.366	659.929	109.377	662.433	109.388	664.937	109.401	667.442	109.415	669.947	109.431	672.453	109.447	674.958	109.465	1800	
1600	538.680	91.279	541.181	91.284	543.684	91.291	546.186	91.299	548.689	91.308	551.193	91.320	553.697	91.332	556.202	91.346	558.707	91.361	561.212	91.379	563.719	91.397	566.225	91.417	568.732	91.438	1600	
1400	432.445	73.026	434.947	73.033	437.450	73.041	439.953	73.051	442.457	73.063	444.961	73.077	447.467	73.093	449.972	73.110	452.479	73.129	454.986	73.150	457.493	73.174	460.001	73.198	462.510	73.225	1400	
1200	361.622	60.858	364.124	60.866	366.627	60.876	369.132	60.888	371.636	60.902	373.142	60.919	376.648	60.938	379.155	60.959	381.662	60.982	384.170	61.007	386.679	61.035	389.189	61.065	391.699	61.097	1200	
1000	326.210	54.773	328.713	54.783	331.217	54.794	333.721	54.808	336.226	54.823	338.732	54.842	341.239	54.863	343.743	54.886	346.255	54.912	348.764	54.940	351.274	54.971	353.785	55.004	356.296	55.040	1000	
900	290.799	48.691	293.302	48.701	295.806	48.713	298.311	48.728	300.817	48.746	303.324	48.767	305.832	48.791	308.340	48.817	310.849	48.846	313.360	48.877	315.871	48.912	318.383	48.949	320.896	48.990	900	
800	255.388	42.608	257.891	42.619	260.396	42.633	262.902	42.650	265.408	42.671	267.916	42.695	270.425	42.722	272.934	42.751	275.445	42.785	277.957	42.821	280.469	42.861	282.983	42.903	285.498	42.949	800	100 (P)*
700	219.976	36.526	222.481	36.539	224.986	36.555	227.493	36.575	230.001	36.599	232.510	36.627	235.020	36.658	237.531	36.693	240.043	36.732	242.557	36.774	245.072	36.820	247.588	36.870	250.104	36.924	700	
600	184.566	30.444	187.071	30.460	189.577	30.479	192.085	30.504	194.595	30.532	197.105	30.565	199.617	30.603	202.131	30.645	204.646	30.691	207.162	30.742	209.679	30.798	212.198	30.857	214.718	30.921	600	
500	149.156	24.364	151.662	24.384	154.170	24.408	156.680	24.439	159.191	24.475	161.703	24.516	164.220	24.563	166.736	24.616	169.255	24.673	171.774	24.737	174.296	24.806	176.819	24.881	179.344	24.961	500	
450	134.992	21.933	137.499	21.951	140.008	21.982	142.519	22.016	145.031	22.056	147.546	22.102	150.063	22.154	152.581	22.212	155.101	22.277	157.623	22.347	160.147	22.424	162.672	22.507	165.200	22.596	450	
400	131.451	21.325	133.958	21.347	136.467	21.376	138.978	21.411	141.492	21.451	144.007	21.499	146.524	21.552	149.043	21.613	151.563	21.679	154.086	21.751	156.610	21.830	159.136	21.913	161.664	22.007	400	
350	113.744	18.288	116.255	18.313	118.766	18.347	121.279	18.387	123.794	18.433	126.311	18.490	128.831	18.553	131.353	18.623	133.876	18.700	136.402	18.785	138.931	18.877	141.460	18.976	143.992	19.083	350	80 (P)*
300	96.043	15.252	98.553	15.283	101.065	15.323	103.581	15.371	106.099	15.429	108.620	15.495	111.143	15.570	113.669	15.654	116.197	15.747	118.728	15.848	121.260	15.958	123.796	16.078	126.333	16.206	300	
250	80.961	14.038	91.472	14.072	93.986	14.115	96.503	14.168	99.022	14.230	101.545	14.303	104.070	14.384	106.598	14.475	109.128	14.576	111.661	14.687	114.196	14.806	116.734	14.936	119.275	15.075	250	
230	78.340	12.219	80.852	12.258	83.368	12.308	85.887	12.369	88.410	12.440	90.935	12.523	93.464	12.617	95.995	12.722	98.529	12.838	101.067	12.965	103.606	13.103	106.149	13.251	108.694	13.411	230	
200	67.719	10.403	70.234	10.443	72.752	10.507	75.274	10.578	77.800	10.663	80.330	10.760	82.863	10.870	85.399	10.994	87.938	11.130	90.481	11.279	93.027	11.441	95.575	11.616	98.127	11.804	200	65 (P)*
175	62.409	9.496	64.925	9.546	67.445	9.610	69.966	9.681	72.497	9.781	75.029	9.887	77.565	10.009	80.104	10.144	82.647	10.293	85.193	10.457	87.742	10.634	90.295	10.826	92.850	11.032	175	
150	51.792	7.686	54.310	7.747	56.834	7.827	59.364	7.924	61.898	8.039	64.436	8.171	66.979	8.321	69.526	8.489	72.077	8.674	74.631	8.876	77.189	9.096	79.750	9.334	82.314	9.589	150	
125	42.944	6.184	45.457	6.262	47.997	6.361	50.533	6.482	53.075	6.626	55.621	6.791	58.172	6.978	60.728	7.187	63.288	7.418	65.852	7.671	68.419	7.945	70.989	8.241	73.563	8.559	125	
100	39.408	5.587	41.932	5.673	44.465	5.783	47.004	5.918	49.549	6.077	52.100	6.261	54.655	6.469	57.215	6.701	59.780	7.957	62.348	7.237	64.919	7.542	67.494	7.870	70.071	8.222	100	50 (P)*
90	35.869	4.992	38.398	5.089	40.934	5.213	43.478	5.363	46.027	5.544	48.582	5.750	51.143	5.984	53.708	6.244	56.277	6.532	58.850	6.847	61.426	7.189	64.005	7.557	66.586	7.952	90	50 (H)**
80	32.333	4.401	34.856	4.512	37.407	4.654	39.955	4.827	42.510	5.031	45.070	5.267	47.636	5.533	50.207	5.831	52.782	6.159	55.359	6.518	57.940	6.907	60.522	7.326	63.106	7.775	80	
70	28.798	3.817	31.336	3.945	33.882	4.111	36.437	4.312	38.998	4.551	41.565	4.825	44.138	5.135	46.714	5.481	49.294	5.863	51.876	6.279	54.460	6.731	57.044	7.217	59.628	7.738	70	40 (P)*
60	27.032	3.527	29.573	3.668	32.122	3.948	34.680	4.068	37.245	4.328	39.816	4.626	42.392	4.964	44.971	5.341	47.553	5.756	50.137	6.209	52.721	6.700	55.305	7.228	57.887	7.793	60	
50	25.267	3.241	27.810	3.396	30.360	3.594	32.926	3.835	35.495	4.121	38.069	4.449	40.648	4.820	43.230	5.233	45.814	5.688	48.398	6.184	50.982	6.722	53.563	7.299	56.141	7.916	50	40 (H)**
45	23.502	2.955	26.050	3.130	28.608	3.350	31.174	3.619	33.747	3.935	36.325	4.299	38.907	4.710	41.491	5.167	44.075	5.670	46.658	6.219	49.238	6.812	51.814	7.449	54.383	8.128	45	35 (P)**
40	21.739	2.682	24.291	2.875	26.854	3.122	29.425	3.423	32.002	3.778	34.584	4.186	37.168	4.647	39.752	5.158	42.334	5.721	44.913	6.333	47.485	6.994	50.049	7.703	52.604	8.458	40	35 (H) 30 (P)*
35	19.977	2.413	22.535	2.633	25.103	2.915	27.680	3.259	30.261	3.663	32.845	4.127	35.429	4.650	38.010	5.230	40.585	5.867	43.153	6.559	45.709	7.304	48.255	8.102	50.781	8.949	35	
33	19.273	2.309	21.834	2.542	24.404	2.841	26.983	3.205	29.565	3.632	32.150	4.123	34.732	4.676	37.310	5.289	39.881	5.961	42.441	6.690	44.988	7.475	47.519	8.314	50.031	9.204	33	
30	18.218	2.156	20.783	2.412	23.357	2.741	25.938	3.140	28.522	3.669	31.105	4.146	33.684	4.750	36.255	5.419	38.815	6.151	41.360	6.944	43.886	7.796	46.390	8.704	48.870	9.666	30	30 (H)**
25	16.463	1.918	19.035	2.224	21.615	2.616	24.199	3.092	26.781	3.650	29.357	4.286	31.920	5.000	34.466	5.787	36.990	6.644	39.488	7.569	41.954	8.556	44.384	9.603	46.775		25	
23	15.762	1.830	18.337	2.163	20.919	2.588	23.503	3.103	26.082	3.706	28.650	4.393	31.201	5.161	33.730	6.006	36.230	6.925	38.696	7.913	41.123	8.964	43.506	10.075			23	25 (P)*
20	14.713	1.712	17.292	2.095	19.876	2.579	22.456	3.167	25.025	3.852	27.573	4.629	30.094	5.495	32.580	6.444	35.024	7.469	37.420	8.564							20	25 (H)**
15	12.969	1.570	15.553	2.073	18.128	2.709	20.680	3.472	23.193	4.352	25.661	5.339	28.065	6.423													15	20 (P)*
14	12.621	1.555	15.204	2.092	17.773	2.770	20.312	3.580	22.806	4.511	25.240	5.551															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 39 Degrees

$\Delta = 39°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	meters	
2500	925.333	152.234	927.838	152.248	930.343	152.264	932.848	152.280	935.354	152.297	937.860	152.316	940.366	152.334	942.873	152.354	945.379	152.375	947.887	152.397	950.394	152.419	952.902	152.443	955.410	152.467	2500	
2200	819.103	133.995	821.608	134.011	824.114	134.029	826.620	134.047	829.127	134.067	831.633	134.088	834.140	134.109	836.648	134.132	839.155	134.156	841.663	134.180	844.172	134.206	846.680	134.232	849.189	134.260	2200	
2000	748.283	121.838	750.789	121.856	753.296	121.875	755.802	212.896	758.309	121.917	760.817	122.940	763.324	121.964	765.833	121.989	768.341	122.015	770.850	122.042	773.359	122.070	775.869	122.099	778.378	122.129	2000	
1800	677.465	109.684	679.971	109.704	682.478	109.726	684.986	109.749	687.494	109.772	690.002	109.797	692.510	109.824	695.019	109.852	697.529	109.880	700.039	109.910	702.549	109.942	705.059	109.974	707.570	110.008	1800	
1500	571.240	91.461	573.747	91.485	576.256	91.511	578.765	91.538	581.274	91.567	583.784	91.597	586.294	91.629	588.805	91.662	591.316	91.697	593.827	91.733	596.340	91.771	598.852	91.809	601.365	91.850	1500	
1200	465.019	73.254	467.529	73.284	470.039	73.316	472.551	73.350	475.062	73.386	477.574	73.424	480.087	73.464	482.600	73.505	485.114	73.548	487.628	73.593	490.143	73.640	492.659	73.689	495.175	73.740	1200	
1000	394.210	61.131	396.722	61.167	399.235	61.206	401.748	61.247	404.262	61.290	406.776	61.335	409.291	61.383	411.807	61.433	414.324	61.485	416.841	61.539	419.359	61.595	421.877	61.654	424.396	61.714	1000	
900	358.809	55.078	361.322	55.118	363.836	55.161	366.350	55.207	368.865	55.254	371.381	55.303	373.898	55.358	376.415	55.413	378.934	55.470	381.453	55.531	383.972	55.593	386.492	55.658	389.014	55.726	900	
800	323.409	49.032	325.924	49.078	328.439	49.126	330.955	49.177	333.472	49.231	335.990	49.288	338.509	49.347	341.029	49.409	343.549	49.474	346.070	49.542	348.592	49.612	351.115	49.685	353.638	49.761	800	
700	288.013	42.998	290.530	43.050	293.047	43.105	295.566	43.164	298.085	43.225	300.605	43.290	303.126	43.358	305.649	43.429	308.172	43.503	310.695	43.580	313.220	43.661	315.746	43.744	318.272	43.831	700	
600	252.622	36.980	255.142	37.041	257.662	37.106	260.183	37.174	262.705	37.246	265.229	37.321	267.753	37.400	270.279	37.483	272.805	37.570	275.333	37.660	277.861	37.753	280.391	37.851	282.921	37.952	600	
500	217.239	30.990	219.762	31.063	222.286	31.140	224.811	31.222	227.337	31.308	299.865	31.398	232.394	31.493	234.924	31.593	237.455	31.697	239.987	31.805	242.521	31.917	245.056	32.034	247.591	32.156	500	
400	181.870	25.046	184.398	25.137	186.927	25.234	189.458	25.336	191.990	25.444	194.524	25.557	197.059	25.676	199.595	25.800	202.133	25.929	204.672	26.064	207.213	26.205	209.755	26.351	212.298	26.503	400	
360	167.728	22.691	170.259	22.792	172.791	22.899	175.325	23.013	177.860	23.132	180.397	23.258	182.935	23.390	185.475	23.528	188.017	23.672	190.560	23.822	193.104	23.978	195.650	24.140	198.197	24.309	360	100 (P)*
350	164.194	22.105	166.725	22.209	169.258	22.319	171.792	22.436	174.329	22.559	176.866	22.688	179.406	22.824	181.947	22.966	184.489	23.114	187.033	23.268	189.578	23.429	192.125	23.595	194.673	23.769	350	
300	146.526	19.197	149.062	19.318	151.600	19.447	154.139	19.583	156.681	19.726	159.224	19.877	161.768	20.035	164.315	20.201	166.863	20.373	169.412	20.553	171.964	20.740	174.516	20.935	177.071	21.137	300	
250	128.873	16.343	131.415	16.488	133.959	16.643	136.504	16.806	139.052	16.978	141.602	17.158	144.154	17.348	146.707	17.546	149.263	17.753	151.820	17.969	154.378	18.193	156.939	18.426	159.501	18.668	250	
230	121.817	15.224	124.362	15.382	126.909	15.550	129.458	15.727	132.009	15.914	134.562	16.110	137.116	17.316	139.674	16.531	142.233	16.756	144.793	16.990	147.356	17.234	149.919	17.487	152.483	17.749	230	80 (P)*
200	111.242	13.582	113.792	13.764	116.344	13.957	118.899	14.160	121.456	14.375	124.015	14.600	126.576	14.837	129.138	15.084	131.703	15.342	134.269	15.611	136.838	15.891	139.407	16.181	141.978	16.483	200	
170	100.681	12.005	103.237	12.219	105.796	12.445	108.358	12.684	110.922	12.936	113.487	13.201	116.055	13.479	118.625	13.769	121.196	14.072	123.769	14.387	126.344	14.716	128.920	15.056	131.497	15.410	170	
155	95.407	11.252	97.968	11.486	100.531	11.734	103.096	11.997	105.664	12.273	108.233	12.563	110.805	12.867	113.378	13.184	115.953	13.516	118.530	13.862	121.108	14.221	123.687	14.594	126.267	14.980	155	65 (P)*
125	84.881	9.861	87.451	10.150	90.023	10.457	92.597	10.781	95.173	11.122	97.751	11.480	100.330	11.855	102.911	12.247	105.493	12.656	108.076	13.082	110.659	13.525	113.243	13.984	115.827	14.460	125	
100	76.138	8.898	78.716	9.258	81.296	9.639	83.878	10.042	86.460	10.466	89.044	10.910	91.628	11.376	94.212	11.862	96.797	12.369	99.380	12.896	101.963	13.443	104.545	14.011	107.126	14.598	100	
90	72.651	8.598	75.232	8.997	77.814	9.419	80.398	9.865	82.982	10.334	85.566	10.826	88.150	11.340	90.734	11.878	93.316	12.437	95.897	13.019	98.476	13.624	101.053	14.256	103.627	14.897	90	50 (P)
80	69.168	8.373	71.752	8.820	74.336	9.293	76.920	9.792	79.504	10.317	82.087	10.867	84.669	11.442	87.248	12.042	89.825	12.666	92.399	13.315	94.970	13.988	97.536	14.685	100.098	15.406	80	30 (H)**
70	65.690	8.254	68.274	8.762	70.858	9.299	73.440	9.865	76.020	10.460	78.597	11.083	81.171	11.734	83.740	12.412	86.305	13.117	88.865	13.850	91.419	14.608	93.966	15.393	96.506	16.203	70	
60	62.211	8.292	64.791	8.879	67.369	9.500	69.942	10.153	72.511	10.838	75.074	11.555	77.630	12.302	80.179	13.080	82.719	13.888	85.250	14.726	87.772	15.592	90.282	16.486	92.781	17.408	60	40 (P)*
55	60.466	8.394	63.042	9.031	65.613	9.703	68.177	10.410	70.735	11.150	73.285	11.924	75.826	12.731	78.357	13.570	80.876	14.440	83.384	15.340	85.879	16.271	88.360	17.230	90.827	18.218	55	
50	58.714	8.573	61.281	9.267	63.840	10.020	66.391	10.769	68.933	11.574	71.463	12.414	73.981	13.289	76.486	14.197	78.976	15.138	81.450	16.110	83.908	17.113	86.348	18.145	88.769	19.206	50	40 (H)**
45	56.945	8.850	59.497	9.613	62.039	10.416	64.569	11.259	67.085	12.139	69.586	13.056	72.070	14.009	74.536	14.997	76.983	16.018	79.409	17.071	81.814	18.155	84.195	19.268	86.552	20.410	45	35 (P)*
40	55.146	9.259	57.675	10.104	60.188	10.991	62.684	11.919	65.160	12.888	67.616	13.894	70.049	14.937	72.457	16.016	74.840	17.127	77.196	18.270							40	30 (H)**
35	53.290	9.846	55.779	10.788	58.245	11.776	60.687	12.806	63.100	13.877	65.485	14.986															35	
33	52.521	10.144	54.987	11.132	57.427	12.163	59.837	13.240	62.216	14.356																	33	30 (P)*
30	51.322	10.679	53.743	11.739	56.130	12.845																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 40 Degrees

$\Delta = 40°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metres	
metres																												
2500	917.426	160.448	919.927	160.451	922.429	160.455	924.930	160.460	927.432	160.466	929.935	160.472	932.437	160.480	934.940	160.488	937.443	160.498	939.947	160.508	942.450	160.519	944.954	160.531	947.459	160.543	2500	
2200	808.235	141.195	810.737	141.198	813.238	141.203	815.740	141.209	818.242	141.215	820.745	141.223	823.248	141.231	825.751	141.241	828.254	141.251	830.758	141.263	833.263	141.276	835.767	141.289	838.272	141.304	2200	
2000	735.442	128.360	737.943	128.364	740.443	128.369	742.947	128.375	745.449	128.382	747.952	128.391	750.455	128.400	752.959	128.410	755.463	128.422	757.967	128.435	760.472	128.449	762.977	128.464	765.482	128.480	2000	
1800	662.648	115.525	665.149	115.529	667.651	115.535	670.153	115.542	672.656	115.550	675.159	115.559	677.663	115.569	680.167	115.581	682.671	115.594	685.176	115.608	687.681	115.624	690.187	115.640	692.693	11 658		
1500	553.457	96.273	555.959	96.278	558.461	96.285	560.964	96.293	563.467	96.302	565.971	96.313	568.475	96.326	570.980	96.340	573.485	96.356	575.991	96.373	578.497	96.391	581.004	96.411	583.511	96.433	1500	
1200	444.267	77.021	446.769	77.028	449.272	77.036	451.775	77.046	454.279	77.058	456.784	77.072	459.289	77.088	461.795	77.105	464.302	77.125	466.809	77.146	469.317	77.169	471.825	77.194	474.334	77.221	1200	
1000	371.473	64.188	373.976	64.195	376.479	64.205	378.984	64.218	381.488	64.232	383.994	64.249	386.500	64.267	389.007	64.288	391.515	64.312	394.023	64.337	396.533	64.365	399.043	64.395	401.553	64.427	1000	
900	335.077	57.771	337.580	57.780	340.083	57.791	342.588	57.804	345.093	57.820	347.600	57.838	350.106	57.860	352.614	57.883	355.123	57.909	357.632	57.937	360.143	57.968	362.654	58.001	365.166	58.037	900	
800	298.680	51.354	301.184	51.364	303.688	51.376	306.193	51.392	308.699	51.410	311.206	51.431	313.714	51.454	316.223	51.480	318.732	51.510	321.243	51.542	323.754	51.576	326.267	51.614	328.780	51.654	800	
700	262.284	44.938	264.788	44.950	267.292	44.964	269.798	44.981	272.305	45.002	274.813	45.026	277.322	45.052	279.832	45.083	282.343	45.116	284.855	45.152	287.368	45.192	289.882	45.235	292.397	45.281	700	100 (P)*
600	225.888	38.523	228.392	38.536	230.898	38.553	233.404	38.573	235.912	38.597	238.422	38.625	240.932	38.656	243.444	38.691	245.956	38.730	248.470	38.772	250.986	38.819	253.502	38.869	256.019	38.922	600	
500	189.492	32.109	191.997	32.124	194.504	32.144	197.012	32.168	199.521	32.197	202.032	32.231	204.545	32.268	207.059	32.310	209.574	32.357	212.091	32.408	214.609	32.463	217.128	32.523	219.649	32.588	500	
400	153.096	25.696	155.603	25.715	158.111	25.740	160.621	25.771	163.133	25.807	165.647	25.848	168.162	25.896	170.680	22.948	173.198	26.006	175.719	26.070	178.241	26.139	180.765	26.214	183.290	26.294	400	
360	138.539	23.132	141.046	23.133	143.555	23.181	146.066	23.815	148.579	23.255	151.094	23.301	153.612	23.353	156.130	23.412	158.651	23.477	161.174	23.547	163.698	23.624	166.224	23.707	168.743	23.797	360	
320	134.899	22.491	137.407	22.513	139.916	22.541	142.428	22.576	144.941	22.617	147.457	22.665	149.974	22.719	152.494	22.779	155.015	22.845	157.538	22.918	160.063	22.997	162.590	23.083	165.119	23.175	320	
300	116.702	19.287	119.211	19.312	121.722	19.346	124.235	19.386	126.751	19.434	129.269	19.490	131.789	19.552	134.312	19.623	136.836	19.700	139.363	19.785	141.892	19.878	144.423	19.977	146.956	20.084	300	80 (P)*
250	98.506	16.084	101.016	16.115	103.529	16.155	106.045	16.204	108.564	16.262	111.085	16.328	113.609	16.403	116.136	16.488	118.665	16.581	121.196	16.683	123.730	16.793	126.267	16.913	128.805	17.041	250	
230	91.228	14.864	93.739	14.838	96.253	14.881	98.770	14.934	101.290	14.997	103.814	15.069	106.339	15.151	108.868	15.243	111.399	15.344	113.933	15.454	116.470	15.575	119.009	15.705	121.550	15.844	230	
200	80.311	12.885	82.823	12.924	85.340	12.974	87.859	13.035	90.382	13.107	92.909	13.190	95.438	13.284	97.970	13.389	100.506	13.506	103.044	13.633	105.585	13.771	108.129	13.921	110.676	14.081	200	
170	69.394	10.969	71.909	11.014	74.428	11.073	76.951	11.145	79.478	11.230	82.008	11.327	84.542	11.438	87.080	11.562	89.621	11.698	92.165	11.848	94.712	12.011	97.262	12.186	99.815	12.375	170	65 (P)*
155	63.937	10.012	66.453	10.062	68.974	10.126	71.499	10.205	74.028	10.298	76.561	10.405	79.098	10.526	81.638	10.662	84.182	10.812	86.730	10.976	89.280	11.154	91.834	11.347	94.392	11.553	155	
125	53.023	8.102	55.543	8.164	58.068	8.244	60.598	8.341	63.133	8.456	65.671	8.589	68.217	8.740	70.766	8.908	73.318	9.093	75.875	9.297	78.435	9.517	80.998	9.755	83.564	10.011	125	
100	43.930	6.518	46.454	6.595	48.985	6.695	51.522	6.816	54.065	6.960	56.613	7.126	59.166	7.314	61.723	7.524	64.285	7.755	66.851	8.009	69.421	8.284	71.994	8.581	74.571	8.899	100	
90	40.293	5.887	42.821	5.973	45.355	6.084	47.895	6.219	50.441	6.379	52.994	6.563	55.551	6.771	58.113	7.004	60.680	7.261	63.251	7.543	65.825	7.848	68.403	8.177	70.983	8.530	90	50 (P)*
80	36.658	5.259	39.188	5.356	41.726	5.490	44.270	5.632	46.822	5.812	49.379	6.019	51.941	6.253	54.509	6.515	57.081	6.804	56.657	7.120	62.236	7.462	64.818	7.832	67.403	8.228	80	50 (H)**
70	33.024	4.635	35.538	4.746	38.100	4.888	40.650	5.062	43.206	5.267	45.769	5.503	48.338	5.770	50.911	6.069	53.489	6.398	56.070	6.758	58.654	7.148	61.240	7.569	63.828	8.019	70	
60	29.391	4.017	31.930	4.146	34.478	4.312	37.034	4.514	39.597	4.753	42.167	5.028	44.742	5.340	47.322	5.687	49.906	6.069	52.492	6.487	55.080	6.940	57.669	7.428	60.257	7.950	60	40 (P)*
55	27.576	3.711	30.118	3.852	32.669	4.033	35.229	4.253	37.796	4.514	40.370	4.814	42.948	5.153	45.531	5.530	48.117	5.947	50.705	6.401	53.294	6.894	55.883	7.423	58.470	7.990	55	
50	25.761	3.408	28.306	3.563	30.862	3.762	33.426	4.004	35.997	4.290	38.575	4.620	41.157	4.992	43.743	5.406	46.331	5.863	48.920	6.361	51.508	6.900	54.095	7.479	56.678	8.098	50	40 (H)**
45	23.947	3.109	26.497	3.281	29.057	3.502	31.625	3.771	34.201	4.089	36.783	4.453	39.369	4.866	41.957	5.324	44.546	5.829	47.134	6.379	49.719	6.974	52.301	7.613	54.876	8.295	45	35 (P)*
40	22.133	2.816	24.689	3.010	27.254	3.258	29.828	3.560	32.409	3.916	34.995	4.325	37.583	4.767	40.172	5.300	42.759	5.864	45.343	6.479	47.921	6.142	50.492	7.853	53.054	8.610	40	35 (H) 30 (P)*
35	20.325	2.531	22.885	2.757	25.456	3.034	28.035	3.379	30.620	3.784	33.208	4.250	35.797	4.774	38.383	5.356	40.965	5.995	43.539	6.689	46.102	7.437	48.653	8.237	51.189	9.087	35	
33	19.601	2.420	22.164	2.654	24.737	2.953	27.319	3.318	29.906	3.747	32.494	4.240	35.082	4.794	37.666	5.409	42.343	6.083	42.810	6.815	45.364	7.602	47.902	8.443	50.423	9.337	33	
30	18.517	2.257	21.084	2.514	23.661	2.843	26.246	3.244	28.834	3.714	31.423	4.253	34.007	4.859	36.584	5.530	39.151	6.265	41.703	7.060	44.237	7.915	46.750	8.826	49.239	9.790	30	30 (H)**
25	16.713	2.002	19.287	2.310	21.872	2.703	24.460	3.180	27.048	3.740	29.629	4.378	32.199	5.094	34.752	5.883	37.284	6.744	39.790	7.671	42.266	8.662	44.706	9.712	47.107	10.817	25	
23	15.993	1.908	18.571	2.242	21.157	2.668	23.746	3.185	26.330	3.789	28.903	4.479	31.463	5.249	33.999	6.097	36.507	7.019	38.983	8.010	41.420	9.064	43.813	10.779			23	25 (P)*
20	14.914	1.780	17.497	2.162	20.086	2.650	22.671	3.239	25.246	3.926	27.802	4.707	30.331	5.575	32.826	6.527	35.279	7.555	37.685	8.653							20	25 (H)**
15	13.123	1.622	15.711	2.126	18.292	2.765	20.851	3.530	23.375	4.413	25.850	5.403	28.264	6.490													15	20 (P)*
14	12.766	1.604	15.353	2.143	17.929	2.823	20.475	3.635	22.978	4.569	25.422	5.612															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 40 Degrees

$\Delta = 40°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	949.963	160.557	952.468	160.372	954.973	160.387	957.479	160.604	959.985	160.621	962.491	160.639	964.997	160.658	967.504	160.678	970.011	160.699	972.518	160.721	975.026	160.744	977.534	160.767	2500			
2200	840.777	141.319	843.283	141.336	845.789	141.354	848.295	141.372	850.802	141.392	853.309	141.413	855.816	141.435	858.324	141.457	860.832	141.481	863.340	141.505	865.848	141.531	868.357	141.558	2200			
2000	767.988	128.497	770.494	128.515	773.000	128.535	775.507	128.555	778.015	128.577	780.522	128.600	783.030	128.623	785.539	128.648	788.047	128.674	790.556	128.701	793.066	128.730	795.576	128.759	2000			
1800	693.199	115.677	697.706	115.698	700.213	115.719	702.721	115.742	705.229	115.766	707.737	115.791	710.246	115.818	712.755	115.845	715.265	115.874	717.775	115.904	720.285	115.936	722.796	115.969	1800			
1500	586.019	96.455	588.527	96.480	591.036	96.506	593.545	96.533	596.054	96.562	598.564	96.592	601.075	96.624	603.586	96.657	606.097	96.692	608.609	96.728	611.122	96.766	613.635	96.805	1500			
1200	478.843	77.250	479.354	77.280	481.864	77.312	484.375	77.346	486.887	77.383	489.400	77.420	491.913	77.460	494.427	77.502	496.941	77.545	499.456	77.590	501.971	77.637	504.487	77.687	1200			
1000	404.065	64.461	406.577	64.498	409.090	64.537	411.603	64.578	414.117	64.621	416.632	64.666	419.148	64.714	421.664	64.764	424.181	64.816	426.699	64.870	429.217	64.927	431.736	64.986	1000			
900	367.678	58.075	370.191	58.116	372.706	58.159	375.220	58.204	377.736	58.252	380.253	58.303	382.770	58.356	385.288	58.411	387.807	58.469	390.326	58.529	392.846	58.592	395.367	58.657	900			
800	331.294	51.697	333.809	51.742	336.325	51.791	338.841	51.842	341.359	51.896	343.877	51.953	346.397	52.013	348.917	52.075	351.438	52.140	353.959	52.208	356.482	52.278	359.005	52.352	800			
700	294.913	45.330	297.430	45.382	299.948	45.438	302.467	45.496	304.987	45.558	307.508	45.622	310.030	45.690	312.552	45.762	315.076	45.836	317.601	45.914	320.126	45.994	322.653	46.078	700			
600	258.538	38.979	261.057	39.041	263.578	39.105	266.100	39.173	268.623	39.243	271.147	39.321	273.672	39.400	276.198	39.484	278.726	39.570	281.254	39.661	283.783	39.755	286.314	39.853	600			
500	222.171	32.656	224.694	32.729	227.218	32.807	229.744	32.889	232.271	32.975	234.800	33.066	237.330	33.161	239.861	33.261	242.393	33.365	244.926	33.474	247.461	33.587	249.996	33.704	500			
400	185.817	26.380	188.346	26.471	190.876	26.568	193.408	26.671	195.941	26.779	198.476	26.892	201.012	27.011	203.549	27.136	206.089	27.266	208.629	27.402	211.171	27.543	213.714	27.689	216.259	27.842	400	100 (P)*
360	171.282	21.892	173.814	23.993	176.347	24.101	178.882	24.215	181.418	24.335	183.956	24.461	186.496	24.593	189.037	24.731	191.580	24.876	194.124	25.026	196.670	25.183	199.217	25.346	201.766	25.515	360	
350	167.649	21.272	170.181	23.377	172.715	23.488	175.251	23.605	177.788	23.728	180.327	23.858	182.868	23.994	185.410	24.136	187.954	24.284	190.499	24.439	193.046	24.601	195.594	24.768	198.144	24.942	350	
300	149.491	20.199	152.028	20.320	154.566	20.449	157.107	20.586	159.650	20.730	162.194	20.881	164.740	21.040	167.288	21.206	169.838	21.378	172.389	21.559	174.942	21.747	177.497	21.942	180.053	22.145	300	
250	131.346	17.178	133.889	17.324	136.435	17.479	138.982	17.643	141.532	17.815	144.083	17.997	146.637	18.187	149.192	18.385	151.749	18.593	154.308	18.810	156.869	19.035	159.431	19.268	161.996	19.511	250	
230	124.094	15.993	126.641	16.152	129.189	16.320	131.740	16.498	134.293	16.685	136.848	16.882	139.405	17.089	141.964	17.305	144.524	17.530	147.087	17.765	149.652	18.010	152.218	18.264	154.786	18.527	230	80 (P)*
200	113.225	14.252	115.777	14.435	118.331	14.628	120.888	14.832	123.447	15.048	126.008	15.274	128.571	15.511	131.136	15.759	133.703	16.018	136.272	16.288	138.842	16.568	141.415	16.860	143.989	17.162	200	
170	102.371	12.576	104.930	12.790	107.491	13.018	110.054	13.258	112.620	13.510	115.189	13.776	117.759	14.054	120.331	14.346	122.906	14.649	125.482	14.966	128.059	15.295	130.638	15.637	133.219	15.992	170	
155	96.951	11.774	99.514	12.009	102.079	12.258	104.647	12.521	107.217	12.798	109.789	13.089	112.364	13.393	114.940	13.712	117.518	14.045	120.098	14.391	122.679	14.752	125.262	15.126	127.846	15.514	155	65 (P)*
125	86.134	10.284	88.706	10.575	91.281	10.882	93.858	11.207	96.437	11.549	99.018	11.908	101.601	12.285	104.185	12.678	106.771	13.088	109.358	13.516	111.945	13.959	114.534	14.420	117.122	14.897	125	
100	77.150	9.239	79.731	9.601	82.314	9.983	84.900	10.387	87.486	10.812	90.074	11.258	92.662	11.725	95.251	12.213	97.840	12.721	100.429	13.250	103.017	13.799	105.604	14.369	108.190	14.958	100	
90	73.566	8.907	76.151	9.307	78.738	9.731	81.325	10.178	83.914	10.649	86.503	11.142	89.092	11.658	91.680	12.197	94.268	12.759	96.854	13.343	99.439	13.949	102.021	14.577	104.601	15.226	90	50 (P)
80	69.989	8.650	72.577	9.099	75.165	9.573	77.754	10.074	80.343	10.600	82.931	11.152	85.518	11.729	88.103	12.331	90.686	12.957	93.266	13.608	95.842	14.283	98.415	14.983	100.984	15.705	80	50 (H)**
70	66.417	8.499	69.006	9.009	71.594	9.548	74.182	10.116	76.767	10.713	79.350	11.337	81.930	11.990	84.506	12.671	87.077	13.378	89.644	14.113	92.204	14.874	94.759	15.661	97.306	16.474	70	
60	62.845	8.506	65.431	9.095	68.014	9.718	70.594	10.373	73.169	11.060	75.738	11.779	78.301	12.529	80.857	13.310	83.405	14.120	85.944	14.960	88.474	15.829	90.992	16.726	93.500	17.651	60	40 (P)*
55	61.055	8.593	63.637	9.232	66.213	9 906	68.785	10.615	71.350	11.358	73.907	12.134	76.455	12.944	78.993	13.785	81.521	14.658	84.038	15.561	86.541	16.495	89.031	17.457	91.507	18.448	55	
50	59.258	8.757	61.831	9.453	64.397	10.188	66.956	10.959	69.504	11.767	72.042	12.610	74.569	13.487	77.082	14.398	79.581	15.342	82.064	16.317	84.531	17.323	86.981	18.359	89.412	19.423	50	40 (H)**
45	57.445	9.019	60.005	9.785	62.554	10.590	65.091	11.435	67.615	12.318	70.125	13.238	72.618	14.194	75.093	15.185	77.550	16.209	79.986	17.266	82.400	18.353	84.792	19.470	87.160	20.615	45	35 (P)*
40	55.604	9.414	58.140	10.261	60.662	11.151	63.166	12.082	65.651	13.054	68.116	14.063	70.559	15.110	72.978	16.191	75.371	17.306	77.737	18.453							40	30 (H)**
35	53.707	9.986	56.204	10.932	58.680	11.923	61.130	12.956	63.554	14.031	65.949	15.143															35	
33	52.922	10.280	55.397	11.271	57.846	12.307	60.267	13.385	62.656	14.505																	33	30 (P)*
30	51.700	10.806	54.131	11.870	56.528	12.980																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE NO : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 41 Degrees

$\Delta = 41°$

Rc	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		Rc	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	942.212	169.026	944.713	169.029	947.215	169.033	949.717	169.038	952.219	169.044	954.721	169.051	957.224	169.058	959.727	169.067	962.230	169.076	964.733	169.086	967.237	169.097	969.741	169.109	972.246	169.122	2500	
2200	830.047	148.744	832.549	148.748	835.050	148.752	837.552	148.758	840.054	148.764	842.557	148.772	845.060	148.780	847.563	148.790	850.067	148.801	852.571	148.812	855.075	148.825	857.580	148.838	860.085	148.853	2200	
2000	755.271	135.223	757.772	135.227	760.274	135.231	762.776	135.238	765.278	135.245	767.781	135.253	770.285	135.263	772.788	135.273	775.292	135.285	777.797	135.298	780.302	135.312	782.807	135.327	785.312	135.343	2000	
1800	680.494	121.701	682.995	121.706	685.497	121.711	688.000	121.718	690.502	121.726	693.006	121.736	695.510	121.746	698.013	121.758	700.518	121.771	703.023	121.785	705.528	121.801	708.034	121.817	710.540	121.835	1800	
1500	568.329	101.420	570.831	101.425	573.333	101.432	575.836	101.440	578.339	101.449	580.843	101.461	583.347	101.473	585.852	101.487	588.358	101.503	590.864	101.520	593.370	101.539	595.877	101.559	598.384	101.580	1500	
1200	456.164	81.139	458.667	81.146	461.169	81.154	463.673	81.164	466.177	81.176	468.682	81.190	471.187	81.206	473.694	81.223	476.200	81.243	478.707	81.264	481.215	81.287	483.724	81.312	486.233	81.339	1200	
1000	381.388	67.619	383.891	67.626	386.394	67.637	388.898	67.649	391.403	67.663	393.909	67.680	396.416	67.699	398.923	67.720	401.431	67.743	403.939	67.769	406.449	67.797	408.959	67.827	411.470	67.859	1000	
900	344.000	60.859	346.503	60.868	349.007	60.879	351.511	60.893	354.017	60.908	356.523	60.927	359.031	60.948	361.539	60.971	364.048	60.998	366.557	61.026	369.068	61.057	371.579	61.090	374.091	61.126	900	
800	306.612	54.100	309.115	54.109	311.620	54.122	314.125	54.137	316.631	54.155	319.138	54.176	321.646	54.200	324.156	54.226	326.665	54.255	329.176	54.287	331.688	54.322	334.201	54.359	336.714	54.400	800	
700	269.224	47.341	271.728	47.352	274.233	47.366	276.739	47.383	279.246	47.404	281.754	47.428	284.263	47.455	286.774	47.485	289.285	47.518	291.798	47.555	294.311	47.595	296.825	47.638	299.341	47.684	700	100 (P)*
600	231.836	40.582	234.341	40.595	236.847	40.612	239.354	40.632	241.862	40.656	244.371	40.684	246.882	40.715	249.394	40.751	251.907	40.790	254.422	40.832	256.937	40.879	259.454	40.929	261.972	40.982	600	
500	194.449	33.824	196.955	33.840	199.461	33.860	201.970	33.885	204.480	33.913	206.991	33.947	209.504	33.985	212.018	34.027	214.534	34.073	217.051	34.125	219.569	34.180	222.089	34.240	224.610	34.305	500	
480	187.062	27.069	189.569	27.088	162.078	27.113	164.588	27.144	167.100	27.180	169.614	27.221	172.130	27.269	174.648	27.322	177.167	27.380	179.688	27.444	182.211	27.513	184.736	27.588	187.262	27.669	480	
460	142.108	24.367	144.613	24.389	147.125	24.416	149.636	24.450	152.150	24.491	154.666	24.537	157.183	24.589	159.703	24.648	162.224	24.713	164.747	24.784	167.272	24.861	169.799	24.944	172.328	25.034	460	
440	138.369	23.692	140.877	23.714	143.387	23.743	145.899	23.778	148.413	23.819	150.929	23.866	153.447	23.920	155.967	23.981	158.489	24.048	161.012	24.121	163.538	24.200	166.066	24.285	168.595	24.378	440	
420	119.677	20.316	122.186	20.342	124.697	20.375	127.211	20.416	129.727	20.464	132.245	20.520	134.766	20.583	137.289	20.653	139.815	20.731	142.342	20.816	144.872	20.909	147.404	21.009	149.938	21.116	420	80 (P)*
400	100.985	16.942	103.495	16.973	106.009	17.013	108.525	17.062	111.045	17.120	113.566	17.187	116.091	17.262	118.618	17.347	121.148	17.440	123.681	17.542	126.216	17.654	128.753	17.773	131.293	17.902	400	
380	93.508	15.594	96.020	15.627	98.535	15.671	101.052	15.724	103.573	15.787	106.097	15.859	108.623	15.942	111.153	16.033	113.685	16.135	116.220	16.246	118.758	16.367	121.298	16.497	123.841	16.637	380	
360	82.294	13.572	84.807	13.611	87.324	13.661	89.844	13.722	92.368	13.794	94.895	13.878	97.425	13.972	99.958	14.077	102.495	14.194	105.035	14.322	107.577	14.461	110.122	14.610	112.671	14.771	360	
340	71.080	11.552	73.596	11.598	76.115	11.657	78.639	11.729	81.166	11.814	83.698	11.912	86.233	12.023	88.771	12.147	91.313	12.284	93.859	12.434	96.407	12.598	98.959	12.774	101.514	12.963	340	65 (P)*
320	65.474	10.544	67.991	10.594	70.512	10.659	73.038	10.738	75.568	10.831	78.102	10.938	80.640	11.060	83.181	11.196	85.727	11.347	88.276	11.511	90.828	11.690	93.384	11.883	95.943	12.090	320	
300	54.261	8.531	56.783	8.593	59.309	8.673	61.840	8.771	64.377	8.887	66.918	9.020	69.463	9.171	72.013	9.340	74.568	9.526	77.126	9.730	79.688	9.951	82.253	10.190	84.822	10.446	300	
280	44.922	6.861	47.442	6.938	49.972	7.039	52.517	7.161	55.061	7.305	57.611	7.472	60.165	7.660	62.725	7.870	65.289	8.103	67.858	8.357	70.430	8.633	73.006	8.931	75.585	9.251	280	
260	41.187	6.196	43.715	6.285	46.250	6.393	48.791	6.529	51.339	6.689	53.893	6.874	56.453	7.083	59.017	7.317	61.586	7.575	64.160	7.857	66.737	8.163	69.317	8.494	71.901	8.848	260	50 (P)*
240	37.452	5.534	39.983	5.631	42.522	5.756	45.068	5.909	47.621	6.089	50.180	6.296	52.745	6.532	55.315	6.794	57.889	7.084	60.468	7.400	63.051	7.744	65.636	8.115	68.225	8.512	240	50 (H)**
220	33.719	4.876	36.254	4.987	38.798	5.129	41.349	5.304	43.908	5.509	46.473	5.746	49.044	6.015	51.620	6.314	54.201	6.644	56.785	7.005	59.373	7.397	61.963	7.819	64.555	8.271	220	
200	29.988	4.223	32.528	4.353	35.077	4.519	37.635	4.722	40.201	4.962	42.773	5.238	45.351	5.550	47.934	5.899	50.521	6.283	53.111	6.702	55.703	7.156	58.297	7.646	60.890	8.169	200	
180	28.123	3.900	30.666	4.042	33.219	4.223	35.781	4.444	38.350	4.706	40.927	5.006	43.509	5.347	46.095	5.726	48.685	6.143	51.277	6.599	53.871	7.093	56.464	7.625	59.057	8.193	180	40 (P)*
160	26.259	3.580	28.805	3.736	31.363	3.935	33.929	4.179	36.503	4.466	39.084	4.796	41.670	5.169	44.259	5.585	46.852	6.043	49.445	6.542	52.039	7.083	54.631	7.664	57.220	8.286	160	40 (H)**
150	24.396	3.365	26.947	3.437	29.508	3.659	32.080	3.929	34.659	4.247	37.244	4.613	39.833	5.026	42.426	5.487	45.019	5.993	47.612	6.545	50.204	7.142	52.795	7.783	55.375	8.467	150	35 (P)*
140	22.534	2.954	25.090	3.148	27.657	3.397	30.234	3.700	32.818	4.057	35.407	4.468	38.000	4.931	40.594	5.446	43.186	6.012	45.776	6.628	48.360	7.294	50.938	8.007	53.506	8.767	140	35 (H) 30 (P)*
130	20.674	2.652	23.236	2.873	25.810	3.157	28.393	3.503	30.982	3.909	33.574	4.376	36.168	4.902	38.759	5.486	41.347	6.127	43.927	6.824	46.498	7.574	49.056	8.376	51.599	9.229	130	
120	19.931	2.534	22.496	2.769	25.072	3.069	27.657	3.435	30.248	3.866	32.841	4.360	35.434	4.916	38.024	5.533	40.607	6.209	43.181	6.943	45.742	7.733	48.288	8.577	50.817	9.473	120	
110	18.818	2.361	21.387	2.619	23.967	2.949	26.556	3.351	29.148	3.823	31.742	4.363	34.332	4.971	36.915	5.645	39.489	6.381	42.048	7.180	44.590	8.037	47.112	8.951	49.609	9.919	110	30 (H)**
100	16.964	2.089	19.542	2.398	22.130	2.792	24.723	3.271	27.315	3.832	29.902	4.473	32.479	5.191	35.040	5.983	37.580	6.846	40.095	7.776	42.579	8.770	45.029	9.823	47.440	10.932	100	25
90	16.225	1.989	18.806	2.323	21.396	2.751	23.990	3.269	26.580	3.876	29.161	4.567	31.726	5.340	34.270	6.191	36.787	7.116	39.272	8.110	41.718	9.168	*44.122	10.286			90	23 (P)*
80	15.117	1.850	17.704	2.234	20.297	2.723	22.888	3.314	25.469	4.004	28.032	4.786	30.569	5.658	33.073	6.612	35.536	7.644	37.952	8.746							80	25 (H)**
70	13.278	1.675	15.871	2.182	18.458	2.822	21.024	3.590	23.576	4.475	26.040	5.469	28.464	6.559													70	20 (P)
60	12.911	1.654	15.504	2.195	18.085	2.877	20.640	3.692	23.151	4.629	25.604	5.675															60	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 16 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 41 Degrees

$\Delta = 41°$

Rc	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		Rc	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	974.750	169.136	977.235	169.151	979.761	169.166	982.267	169.183	984.772	169.200	987.279	169.218	989.785	169.237	992.292	169.258	994.800	169.278	997.307	169.300	999.815	169.323	1002.323	169.346	1004.831	169.371	2500	
2200	862.590	148.869	865.096	148.885	867.602	148.903	870.109	148.922	872.616	148.942	875.123	148.962	877.630	148.984	880.138	149.007	882.646	149.031	885.155	149.055	887.663	149.081	890.173	149.108	892.682	149.135	2200	
2000	787.818	135.360	790.324	135.378	792.831	135.398	795.338	135.418	797.846	135.440	800.354	135.463	802.862	135.487	805.370	135.512	807.879	135.538	810.388	135.565	812.898	135.594	815.408	135.623	817.918	135.654	2000	
1800	713.047	121.854	715.534	121.875	718.061	121.896	720.569	121.919	723.077	121.943	725.586	121.968	728.095	121.995	730.604	122.023	733.114	122.052	735.625	122.082	738.135	122.114	740.646	122.146	743.158	122.180	1800	
1500	600.892	101.603	603.400	101.627	605.909	101.654	608.419	101.681	610.928	101.710	613.439	101.740	615.950	101.772	618.461	101.805	620.973	101.840	623.485	101.877	625.998	101.915	628.511	101.954	631.025	101.994	1500	
1200	488.743	81.368	491.253	81.398	493.764	81.431	496.276	81.465	498.788	81.501	501.301	81.539	503.814	81.579	506.329	81.621	508.843	81.664	511.358	81.710	513.874	81.757	516.391	81.806	518.908	81.857	1200	
1000	413.982	67.894	416.494	67.930	419.008	67.969	421.521	68.010	424.036	68.054	426.551	68.099	429.067	68.147	431.584	68.197	434.102	68.249	436.620	68.304	439.139	68.361	441.658	68.419	444.178	68.480	1000	
900	376.604	61.164	379.118	61.205	381.633	61.248	384.148	61.294	386.664	61.342	389.181	61.393	391.698	61.446	394.217	61.501	396.736	61.560	399.256	61.620	401.777	61.683	404.299	61.749	406.821	61.816	900	
800	339.229	54.443	341.744	54.489	344.260	54.537	346.778	54.589	349.296	54.643	351.815	54.700	354.334	54.760	356.855	54.822	359.377	54.887	361.899	54.956	364.422	55.026	366.946	55.100	369.471	55.177	800	
700	301.857	47.733	304.375	47.785	306.893	47.841	309.413	47.900	311.933	47.962	314.455	48.027	316.977	48.095	319.500	48.167	322.025	48.241	324.550	48.319	327.076	48.400	329.604	48.484	332.132	48.571	700	
600	264.491	41.040	267.011	41.101	269.532	41.166	272.055	41.234	274.579	41.307	277.104	41.382	279.629	41.462	282.156	41.546	284.684	41.633	287.214	41.723	289.744	41.818	292.275	41.916	294.808	42.018	600	
500	227.133	34.374	229.657	34.447	232.182	34.525	234.709	34.607	237.237	34.694	239.766	34.785	242.297	34.880	244.829	34.980	247.362	35.085	249.896	35.194	252.432	35.307	254.969	35.425	257.507	35.547	500	
400	189.790	27.755	192.319	27.847	194.850	27.944	197.383	28.047	199.917	28.155	202.453	28.269	204.990	28.388	207.529	28.513	210.069	28.644	212.611	28.780	215.154	28.921	217.699	29.068	220.245	29.221	400	
360	174.859	25.130	177.391	25.231	179.925	25.340	182.461	25.454	184.999	25.574	187.538	25.700	190.079	25.833	192.621	25.972	195.165	26.117	197.711	26.268	200.258	26.425	202.807	26.588	205.357	26.758	360	100 (P)*
350	171.127	24.476	173.660	24.581	176.195	24.692	178.732	24.809	181.270	24.933	183.811	25.063	186.352	25.200	188.896	25.343	191.441	25.491	193.988	25.647	196.536	25.809	199.089	25.976	201.637	26.151	350	
300	152.474	21.231	155.012	21.353	157.552	21.483	160.094	21.620	162.638	21.764	165.184	21.916	167.731	22.075	170.281	22.241	172.832	22.415	175.385	22.596	177.940	22.784	180.496	22.980	183.054	23.183	300	
250	133.835	18.040	136.380	18.187	138.927	18.342	141.476	18.506	144.027	18.679	146.580	18.861	149.135	19.052	151.692	19.251	153.252	19.459	156.813	19.676	159.375	19.902	161.940	20.137	164.507	20.380	250	
230	126.386	16.787	128.934	16.946	131.484	17.115	134.036	17.293	136.591	17.481	139.148	17.678	141.707	17.885	144.268	18.102	146.831	18.328	149.395	18.564	151.962	18.809	154.531	19.064	157.101	19.328	230	80 (P)*
200	115.221	14.943	117.775	15.126	120.331	15.320	122.889	15.525	125.450	15.741	128.013	15.968	130.578	16.206	133.146	16.455	135.715	16.714	138.287	16.985	140.860	17.266	143.435	17.559	146.012	17.862	200	
170	104.072	13.165	106.633	13.380	109.196	13.608	111.762	13.848	114.330	14.102	116.901	14.369	119.474	14.648	122.049	14.940	124.626	15.245	127.205	15.562	129.785	15.893	132.368	16.236	134.952	16.591	170	
155	98.505	12.312	101.070	12.547	103.638	12.797	106.208	13.061	108.780	13.339	111.355	13.631	113.933	13.936	116.512	14.256	119.093	14.590	121.676	14.938	124.261	15.299	126.847	15.675	129.435	16.064	155	65 (P)*
125	87.394	10.720	89.969	11.012	92.547	11.320	95.127	11.646	97.709	11.990	100.294	12.359	102.880	12.727	105.468	13.122	108.058	13.534	110.648	13.962	113.240	14.408	115.833	14.870	118.426	15.349	125	
100	78.167	9.592	80.732	9.954	83.339	10.338	85.928	10.743	88.519	11.170	91.110	11.617	93.703	12.086	96.297	12.575	98.890	13.085	101.484	13.615	104.077	14.166	106.670	14.737	109.261	15.329	100	
90	74.488	9.226	77.076	9.628	79.667	10.053	82.259	10.501	84.852	10.973	87.445	11.468	90.039	11.986	92.632	12.527	95.225	13.090	97.817	13.676	100.407	14.284	102.996	14.914	105.582	15.566	90	50 (P)
80	70.815	8.936	73.407	9.386	76.000	9.862	78.593	10.364	81.187	10.892	83.780	11.446	86.372	12.024	88.963	12.628	91.552	13.257	94.138	13.910	96.721	14.587	99.300	15.289	101.876	16.014	80	50 (H)**
70	67.148	8.753	69.742	9.264	72.335	9.805	74.928	10.374	77.519	10.973	80.108	11.600	82.694	12.255	85.276	12.937	87.854	13.647	90.427	14.384	92.995	15.148	95.557	15.937	98.112	16.753	70	
60	63.483	8.727	66.075	9.318	68.664	9.943	71.249	10.600	73.831	11.289	76.407	12.011	78.977	12.763	81.540	13.546	84.096	14.359	86.643	15.202	89.180	16.074	91.707	16.974	94.223	17.902	60	40 (P)*
55	61.648	8.798	64.235	9.439	66.818	10.115	69.396	10.826	71.968	11.572	74.532	12.351	77.088	13.163	79.634	14.007	82.170	14.882	84.695	15.789	87.207	16.725	89.706	17.691	92.191	18.685	55	
50	59.805	8.946	62.385	9.645	64.958	10.382	67.524	11.156	70.090	11.966	72.654	12.812	75.214	13.692	77.682	14.606	80.189	15.553	82.682	16.531	85.159	17.540	87.618	18.579	90.058	19.647	50	40 (H)**
45	57.948	9.193	60.515	9.961	63.072	10.769	65.617	11.617	68.150	12.503	70.667	13.426	73.169	14.385	75.654	15.379	78.120	16.407	80.566	17.466	82.991	18.557	85.393	19.678	87.771	20.826	45	35 (P)*
40	56.064	9.573	58.608	10.423	61.138	11.316	63.651	12.250	66.146	13.225	68.620	14.238	71.072	15.288	73.501	16.373	75.905	17.491	78.282	18.642							40	30 (H)**
35	54.126	10.131	56.632	11.080	59.117	12.074	61.577	13.111	64.011	14.189	66.417	15.305															35	
33	53.325	10.419	55.809	11.413	58.268	12.453	60.699	13.535	63.099	14.658																	33	30 (P)*
30	52.080	10.938	54.521	12.005	56.928	13.118																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 42 Degrees

$\Delta = 42°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	967.161	177.866	969.662	177.870	972.163	177.874	974.665	177.879	977.167	177.885	979.669	177.891	982.172	177.899	984.675	177.907	987.179	177.917	989.682	177.927	992.186	177.938	994.690	177.950	997.195	177.963	2500	
2250	852.002	156.524	854.503	156.527	857.005	156.532	859.507	156.537	862.009	156.544	864.512	156.552	867.015	156.560	869.518	156.570	872.022	156.581	874.526	156.592	877.031	156.605	879.535	156.618	882.041	156.633	2250	
2000	773.229	142.295	777.730	142.299	780.232	142.304	782.735	142.310	785.237	142.318	787.740	142.326	790.244	142.335	792.747	142.346	795.251	142.358	797.756	142.370	800.261	142.385	802.766	142.399	805.272	142.416	2000	
1800	698.457	128.067	700.958	128.071	703.460	128.076	705.963	128.083	708.466	128.092	710.969	128.101	713.473	128.111	715.977	128.123	718.481	128.136	720.986	128.150	723.492	128.166	725.998	128.183	728.504	128.200	1800	
1500	583.298	106.724	585.800	106.730	588.302	106.736	590.805	106.744	593.309	106.754	595.813	106.765	598.317	106.778	600.822	106.792	603.328	106.808	605.833	106.825	608.340	106.843	610.847	106.864	613.355	106.885	1500	
1200	468.139	85.382	470.642	85.389	473.145	85.397	475.648	85.407	478.153	85.420	480.657	85.434	483.163	85.449	485.669	85.467	488.176	85.487	490.684	85.508	493.192	85.531	495.701	85.556	498.210	85.583	1200	
1000	391.367	71.155	393.870	71.163	396.374	71.173	398.878	71.183	401.383	71.200	403.889	71.217	406.396	71.236	408.903	71.257	411.411	71.280	413.920	71.306	416.430	71.333	418.941	71.364	421.452	71.396	1000	
900	352.981	64.042	355.484	64.051	357.989	64.062	360.493	64.075	362.999	64.091	365.505	64.110	368.013	64.131	370.521	64.155	373.030	64.181	375.540	64.209	378.051	64.240	380.563	64.273	383.075	64.310	900	
800	314.595	56.929	317.099	56.938	319.604	56.951	322.109	56.966	324.615	56.984	327.122	57.005	329.631	57.029	332.140	57.055	334.650	57.085	337.161	57.117	339.674	57.152	342.187	57.189	344.701	57.230	800	
700	276.210	49.816	278.714	49.827	281.219	49.841	283.725	49.859	286.232	49.880	288.741	49.904	291.250	49.931	293.761	49.961	296.272	49.994	298.785	50.031	301.299	50.071	303.814	50.114	306.329	50.160	700	100 (P)*
600	237.824	42.704	240.329	42.717	242.835	42.734	245.342	42.754	247.850	42.778	250.360	42.806	252.871	42.838	255.383	42.873	257.897	42.912	260.412	42.955	262.928	43.001	265.445	43.052	267.963	43.105	600	
500	199.439	35.593	201.948	35.608	204.457	35.628	206.960	35.653	209.470	35.682	211.982	35.715	214.495	35.753	217.010	35.796	219.526	35.842	222.043	35.894	224.562	35.950	227.083	36.010	229.605	36.075	500	
450	161.054	28.483	163.561	28.503	166.070	28.528	168.581	28.558	171.093	28.595	173.608	28.637	176.124	28.684	178.642	28.737	181.162	28.795	183.684	28.860	186.207	28.929	188.732	29.005	191.259	29.085	450	
400	142.701	25.640	145.208	25.662	150.718	25.690	153.230	25.724	155.744	25.764	158.260	25.811	160.778	25.863	163.298	25.922	165.820	25.987	168.344	26.058	170.870	26.136	173.398	26.219	175.927	26.309	400	
350	141.862	24.929	144.370	24.953	146.880	24.980	149.393	25.016	151.907	25.057	154.423	25.105	156.942	25.159	159.462	25.219	161.985	25.286	164.509	25.360	167.036	25.439	169.564	25.525	172.093	25.618	350	
300	122.671	21.377	125.180	21.403	127.692	21.437	130.206	21.477	132.722	21.526	135.241	21.582	137.763	21.645	140.287	21.715	142.813	21.793	145.341	21.879	147.872	21.972	150.404	22.072	152.939	22.180	300	80 (P)*
250	103.480	17.826	105.991	17.858	108.505	17.898	111.022	17.947	113.541	18.005	116.064	18.072	118.589	18.148	121.117	18.232	123.648	18.326	126.182	18.429	128.718	18.540	131.256	18.660	133.797	18.790	250	
230	95.804	16.407	98.316	16.441	100.831	16.483	103.349	16.538	105.870	16.601	108.395	16.674	110.922	16.756	113.453	16.848	115.986	16.950	118.522	17.062	121.061	17.183	123.602	17.313	126.146	17.454	230	
200	84.290	14.279	86.804	14.318	89.321	14.368	91.842	14.430	94.366	14.502	96.894	14.586	99.425	14.681	101.960	14.787	104.497	14.904	107.038	15.032	109.582	15.171	112.128	15.321	114.678	15.483	200	
175	72.778	12.134	75.293	12.200	77.813	12.259	80.338	12.331	82.866	12.416	85.398	12.515	87.934	12.626	90.474	12.750	93.017	12.888	95.564	13.039	98.114	13.202	100.668	13.379	103.224	13.569	175	65 (P)*
150	67.022	11.092	69.539	11.143	72.061	11.207	74.587	11.287	77.118	11.380	79.653	11.488	82.192	11.610	84.735	11.747	87.282	11.898	89.832	12.063	92.387	12.242	94.944	12.436	97.505	12.644	150	
125	55.511	8.973	58.032	9.036	60.559	9.116	63.091	9.214	65.628	9.330	68.170	9.466	70.717	9.615	73.269	9.784	75.825	9.971	78.385	10.176	80.949	10.398	83.517	10.638	86.088	10.895	125	
100	45.921	7.215	48.447	7.293	50.980	7.383	53.519	7.516	56.064	7.661	58.615	7.828	61.172	8.017	63.733	8.228	66.300	8.461	68.871	8.716	71.445	8.993	74.024	9.292	76.606	9.612	100	
90	42.086	6.515	44.613	6.601	47.151	6.713	49.694	6.849	52.243	7.010	54.799	7.195	57.360	7.405	59.927	7.638	62.498	7.898	65.074	8.181	67.654	8.488	70.238	8.820	72.825	9.173	90	50 (P)*
80	38.252	5.817	40.784	5.915	43.328	6.040	45.871	6.193	48.426	6.374	50.987	6.582	53.554	6.818	56.126	7.081	58.703	7.372	61.285	7.690	63.871	8.035	66.460	8.407	69.052	8.805	80	30 (H)**
70	34.419	5.124	36.933	5.215	39.300	5.378	42.053	5.553	44.613	5.739	47.181	5.997	49.754	6.267	52.333	6.567	54.917	6.898	57.505	7.260	60.096	7.653	62.690	8.077	65.287	8.530	70	
60	30.588	4.436	33.129	4.566	35.680	4.733	38.240	4.937	40.805	5.177	43.383	5.454	45.964	5.767	48.550	6.117	51.141	6.502	53.735	6.923	56.331	7.379	58.929	7.870	61.528	8.395	60	
50	26.673	4.095	31.218	4.327	33.772	4.419	36.336	4.661	38.909	4.903	41.488	5.205	44.073	5.546	46.663	5.927	49.257	6.346	51.853	6.803	54.451	7.299	57.050	7.832	59.648	8.402	50	
45	26.789	3.738	29.308	3.914	31.867	4.114	34.435	4.358	37.012	4.646	39.596	4.977	42.185	5.352	44.779	5.769	47.375	6.228	49.974	6.730	52.572	7.272	55.170	7.855	57.765	8.479	45	40 (H)**
40	24.847	3.424	27.399	3.598	29.963	3.820	32.537	4.091	35.119	4.410	37.708	4.777	40.301	5.192	42.898	5.654	45.496	6.162	48.096	6.716	50.697	7.315	53.298	7.958	55.903	8.644	40	35 (P)*
35	22.936	3.097	25.493	3.291	28.062	3.541	30.643	3.845	33.230	4.203	35.823	4.615	38.420	5.080	41.018	5.597	43.616	6.165	46.212	7.783	48.802	7.450	51.387	8.166	53.962	8.929	35	35 (H) 30 (P)*
30	21.026	2.777	23.590	2.999	26.167	3.283	28.752	3.630	31.345	4.038	33.942	4.507	36.541	5.035	39.138	5.621	41.731	6.264	44.318	6.982	46.896	7.715	49.461	8.520	52.013	9.376	30	
33	20.263	2.652	22.830	2.887	25.409	3.189	27.998	3.556	30.593	3.988	33.191	4.484	35.789	5.041	38.384	5.660	40.973	6.339	43.554	7.075	46.123	7.868	48.677	8.715	51.214	9.614	33	
30	19.120	2.468	21.691	2.727	24.275	3.058	26.867	3.461	29.465	3.935	32.063	4.477	34.659	5.087	37.249	5.763	39.829	6.502	42.395	7.303	44.946	8.163	47.476	9.080	49.982	10.081	30	30 (H)**
25	17.218	2.179	19.798	2.489	22.389	2.884	24.987	3.365	27.585	3.928	30.178	4.571	32.761	5.291	35.330	6.066	37.878	6.952	40.401	7.885	42.895	8.882	45.355	9.939	47.776	11.051	25	
23	16.458	2.071	19.042	2.407	21.637	2.836	24.235	3.356	26.831	3.965	29.418	4.659	31.991	5.434	34.543	6.288	37.079	7.215	39.562	8.213	42.019	9.274	44.433	10.396			23	25 (P)*
20	15.321	1.882	17.912	2.308	20.509	2.798	23.106	3.391	25.693	4.083	28.264	4.869	30.809	5.743	33.322	6.701	35.795	7.735	38.221	8.841							20	25 (H)**
15	13.434	1.751	16.031	2.239	18.624	2.881	21.198	3.651	23.738	4.540	26.231	5.537	28.666	6.631													15	20 (P)*
14	13.057	1.706	15.635	2.248	18.243	2.933	20.805	3.750	23.325	4.690	25.788	5.741															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 42 Degrees

$\Delta = 42°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	999.700	177.977	1002.205	177.991	1004.710	178.007	1007.217	178.024	1009.722	178.041	1012.229	178.060	1014.736	178.079	1017.243	178.099	1019.750	178.120	1022.258	178.142	1024.766	178.164	1027.274	178.188	1029.783	178.213	2500	
2200	884.546	156.949	887.052	156.666	889.558	156.683	892.065	156.702	894.572	156.722	897.079	156.743	899.587	156.765	902.095	156.787	904.603	156.811	907.112	156.836	909.621	156.862	912.130	156.889	914.640	156.917	2200	
2000	807.778	142.433	810.284	142.451	812.792	142.471	815.299	142.491	817.806	142.513	820.314	142.536	822.823	142.560	825.332	142.585	827.841	142.612	830.350	142.639	832.860	142.667	835.371	142.697	837.881	142.727	2000	
1800	731.011	128.320	733.518	128.340	736.026	128.362	738.534	128.385	751.042	128.309	743.551	128.334	746.060	128.361	748.570	128.389	751.080	128.418	753.591	128.448	756.102	128.480	758.614	128.513	761.125	128.547	1800	
1600	615.863	106.908	618.371	106.933	620.881	106.959	623.390	106.986	625.900	107.015	628.411	107.045	630.922	107.078	633.434	107.111	635.946	107.146	638.458	107.183	640.972	107.220	643.485	107.260	646.000	107.301	1600	
1400	500.720	85.612	503.231	85.643	505.742	85.675	508.254	85.709	510.767	85.746	513.280	85.784	515.794	85.824	518.308	85.866	520.823	85.910	523.339	85.955	525.855	86.002	528.372	86.052	530.890	86.103	1400	
1200	423.964	71.431	426.477	71.468	428.990	71.506	431.504	71.548	434.020	71.592	436.535	71.637	439.052	71.685	441.569	71.735	444.087	71.788	446.605	71.842	449.125	71.899	451.645	71.958	454.166	72.020	1200	
1000	385.588	64.348	388.103	64.389	390.618	64.432	393.133	64.478	395.650	64.526	398.167	64.577	400.686	64.630	403.204	64.686	405.724	64.744	408.245	64.805	410.766	64.868	413.288	64.934	415.812	65.002	1000	
900	347.216	57.873	349.731	57.919	352.248	57.968	354.766	57.419	357.284	57.474	359.804	57.531	362.324	57.591	364.845	57.654	367.367	57.719	369.891	57.788	372.414	57.859	374.939	57.933	377.465	58.009	900	
800	308.846	50.899	311.365	50.262	313.884	50.318	316.403	50.377	318.925	50.439	321.447	50.504	323.970	50.573	326.494	50.645	329.019	50.719	331.545	50.797	334.072	50.879	336.600	50.963	339.129	51.051	800	
700	270.483	43.163	273.004	43.224	275.526	43.290	278.049	43.358	280.573	43.431	283.099	43.507	285.625	43.587	288.153	43.671	290.682	43.758	293.212	43.849	295.743	43.944	298.275	44.042	300.809	44.144	700	
600	232.128	36.144	234.653	36.217	237.179	36.295	239.706	36.378	242.235	36.465	244.765	36.556	247.297	36.652	249.829	36.752	252.363	36.857	254.899	36.966	257.436	37.080	259.973	37.198	262.513	37.321	600	
500	193.788	29.172	196.318	29.264	198.850	29.361	201.384	29.465	203.919	29.573	206.456	29.688	208.994	29.807	211.534	29.933	214.076	30.063	216.619	30.200	219.163	30.342	221.709	30.490	224.257	30.643	500	
400	154.459	26.405	180.992	26.507	183.527	26.616	186.064	26.730	188.603	26.851	191.143	26.978	193.685	27.111	196.229	27.250	198.775	27.396	201.322	27.547	203.870	27.703	206.421	27.869	208.972	28.039	400	100 (P)*
350	174.627	23.716	177.161	25.822	179.697	25.933	182.235	26.051	184.775	26.175	187.316	26.306	189.860	26.442	192.404	26.586	194.951	26.735	197.499	26.891	200.049	27.055	202.600	27.222	205.153	27.397	350	
300	155.476	22.295	158.016	22.417	160.557	22.548	163.100	22.685	165.645	22.830	168.193	22.982	170.742	23.141	173.293	23.309	175.846	23.483	178.401	23.664	180.957	23.854	183.515	24.050	186.075	24.254	300	
250	136.341	18.928	138.887	19.075	141.435	19.231	143.985	19.395	146.538	19.569	149.093	19.751	151.650	19.943	154.209	20.143	156.770	20.352	159.333	20.570	161.898	20.796	164.465	21.031	167.034	21.276	250	
230	128.693	17.604	131.242	17.764	133.794	17.933	136.348	18.112	138.904	18.301	141.463	18.499	144.024	18.707	146.587	18.924	149.152	19.151	151.719	19.387	154.288	19.633	156.859	19.889	159.432	20.154	230	80 (P)*
200	117.221	15.655	119.786	15.839	122.344	16.033	124.904	16.239	127.467	16.456	130.032	16.683	132.599	16.922	135.169	17.172	137.741	17.432	140.315	17.704	142.891	17.986	145.469	18.280	148.048	18.584	200	
170	103.784	13.772	106.347	13.987	110.912	14.216	113.480	14.457	116.051	14.712	118.624	14.979	121.200	15.259	123.777	15.553	126.357	15.858	128.939	16.177	131.523	16.508	134.109	16.853	136.696	17.209	170	
155	100.069	12.865	102.636	13.102	105.206	13.353	107.779	13.617	110.354	13.896	112.932	14.189	115.512	14.496	118.094	14.817	120.678	15.152	123.265	15.501	125.853	15.863	128.442	16.240	131.034	16.630	155	65 (P)*
125	84.663	11.170	91.240	11.462	93.821	11.772	96.404	12.099	98.990	12.443	101.578	12.805	104.168	13.184	106.759	13.580	109.353	13.993	111.947	14.422	114.543	14.869	117.140	15.333	119.738	15.813	125	
100	79.192	9.353	81.780	10.318	84.371	10.704	86.963	11.110	89.558	11.538	92.154	11.987	94.751	12.457	97.349	12.948	99.947	13.459	102.546	13.992	105.144	14.544	107.742	15.117	110.339	15.711	100	
90	73.415	9.355	78.008	9.958	80.602	10.384	83.198	10.834	85.795	11.308	88.394	11.804	90.992	12.324	93.591	12.867	96.189	13.432	98.786	14.019	101.382	14.629	103.976	15.261	106.569	15.915	90	50 (P)
80	71.646	9.130	74.242	9.682	76.840	10.160	79.438	10.664	82.037	11.193	84.635	11.749	87.233	12.329	89.829	12.935	92.423	13.566	95.016	14.221	97.605	14.901	100.191	15.604	102.773	16.332	80	50 (H)**
70	67.884	9.013	70.483	9.527	73.081	10.069	75.679	10.641	78.276	11.241	80.870	11.870	83.462	12.527	86.051	13.212	88.636	13.924	91.216	14.664	93.791	15.430	96.360	16.222	98.923	17.040	70	
60	64.126	8.354	66.723	9.548	69.318	10.174	71.909	10.834	74.497	11.525	77.080	12.249	79.657	13.004	82.228	13.790	84.791	14.606	87.346	15.451	89.891	16.326	92.427	17.229	94.951	18.160	60	40 (P)*
55	62.244	9.009	64.837	9.632	67.427	10.331	70.011	11.045	72.590	11.792	75.162	12.574	77.725	13.388	80.279	14.235	82.824	15.114	85.357	16.023	87.878	16.963	90.386	17.931	92.880	18.929	55	
50	60.356	9.141	62.942	9.843	65.523	10.582	68.095	11.358	70.659	12.171	73.213	13.020	75.756	13.903	78.286	14.820	80.802	15.770	83.304	16.751	85.790	17.764	88.259	18.806	90.709	19.878	50	40 (H)**
45	58.455	9.173	61.029	10.143	63.593	10.954	66.146	11.805	68.687	12.694	71.213	13.620	73.724	14.582	76.218	15.579	78.694	16.610	81.150	17.673	83.585	18.768	85.997	19.892	88.386	21.044	45	35 (P)*
40	56.527	9.237	59.080	10.590	61.618	11.486	64.140	12.423	66.643	13.401	69.127	14.417	71.589	15.471	74.028	16.559	76.442	17.682	78.830	18.836							40	30 (H)**
35	54.548	10.281	57.063	11.233	59.557	12.230	62.027	13.270	64.471	14.352	66.887	15.471															35	
33	53.731	10.563	56.225	11.560	58.693	12.603	61.134	13.689	63.544	14.816																	33	30 (P)*
30	52.463	11.073	54.913	12.145	57.332	13.261																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 43 Degrees

$\Delta = 43°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	992.277	186.969	994.778	186.973	997.280	186.977	999.781	186.981	1002.283	186.988	1004.786	186.994	1007.289	187.002	1009.792	187.010	1012.295	187.020	1014.799	187.030	1017.303	187.041	1019.807	187.053	1022.312	187.066	2500	
2200	874.104	164.534	876.605	164.538	879.107	164.542	881.609	164.548	884.112	164.554	886.614	164.562	889.117	164.571	891.621	164.581	894.125	164.591	896.629	164.603	899.134	164.616	901.639	164.629	904.144	164.644	2200	
2000	795.322	149.577	797.824	149.581	800.325	149.586	802.828	149.593	805.330	149.600	807.833	149.608	810.337	149.618	812.841	149.628	813.345	149.640	817.850	149.651	820.355	149.667	822.860	149.682	825.366	149.698	2000	
1800	716.540	134.621	719.042	134.625	721.544	134.631	724.046	134.637	726.550	134.646	729.053	134.655	731.557	134.666	734.061	134.679	736.566	134.690	739.071	134.705	741.577	134.720	744.083	134.737	746.589	134.755	1800	
1500	598.368	112.186	600.870	112.191	603.372	112.198	605.875	112.206	608.379	112.216	610.883	112.227	613.387	112.240	615.892	112.254	618.398	112.270	620.904	112.287	623.411	112.305	625.918	112.326	628.426	112.347	1500	
1200	480.195	89.752	482.698	89.758	485.201	89.767	487.705	89.777	490.209	89.789	492.714	89.803	495.220	89.819	497.726	89.837	500.233	89.856	502.741	89.878	505.249	89.901	507.758	89.926	510.268	89.953	1200	
1000	401.414	74.796	403.917	74.804	406.420	74.814	408.925	74.827	411.430	74.841	413.936	74.858	416.443	74.877	418.951	74.898	421.459	74.922	423.968	74.947	426.478	74.975	428.989	75.006	431.501	75.038	1000	
900	362.023	67.319	364.526	67.327	367.031	67.339	369.535	67.353	372.041	67.368	374.548	67.387	377.056	67.408	379.564	67.432	382.074	67.458	384.583	67.487	387.095	67.518	389.607	67.551	392.120	67.588	900	
800	322.633	59.842	325.136	59.851	327.641	59.864	330.146	59.879	332.653	59.897	335.160	59.918	337.669	59.942	340.179	59.969	342.689	59.998	345.200	60.031	347.713	60.065	350.226	60.103	352.741	60.144	800	100 (P)*
700	283.242	52.365	285.747	52.376	288.251	52.390	290.758	52.408	293.266	52.429	295.774	52.453	298.284	52.480	300.795	52.510	303.307	52.544	305.820	52.581	308.334	52.621	310.849	52.664	313.365	52.710	700	
600	243.852	44.888	246.357	44.902	248.863	44.918	251.370	44.939	253.879	44.963	256.389	44.991	258.900	45.023	261.413	45.058	263.927	45.097	266.442	45.140	268.958	45.187	271.476	45.238	273.995	45.292	600	
500	204.462	37.413	206.968	37.429	209.475	37.449	211.984	37.474	214.495	37.503	217.007	37.536	219.520	37.574	222.035	37.617	224.552	37.664	227.070	37.716	229.589	37.771	232.110	37.832	234.633	37.897	500	
400	165.073	29.940	167.580	29.959	170.089	29.985	172.600	30.015	175.113	30.052	177.628	30.084	180.145	30.141	182.663	30.194	185.184	30.253	187.706	30.318	190.230	30.387	192.756	30.463	195.284	30.544	400	
360	149.318	26.951	151.826	26.973	154.336	27.001	156.848	27.035	159.362	27.075	161.878	27.122	164.397	27.175	166.918	27.234	169.440	27.299	171.965	27.371	174.491	27.448	177.020	27.532	179.550	27.623	360	
350	145.379	26.204	147.887	26.226	150.397	26.255	152.910	26.290	155.425	26.332	157.941	26.380	160.460	26.434	162.982	26.495	165.505	26.562	168.030	26.636	170.557	26.716	173.087	26.802	175.618	26.895	350	80 (P)*
300	125.685	22.469	128.193	22.496	130.707	22.529	133.221	22.570	135.738	22.619	138.258	22.675	140.780	22.738	143.304	22.809	145.831	22.887	148.360	22.973	150.891	23.066	153.425	23.167	155.961	23.275	300	
250	105.992	18.737	108.503	18.768	111.018	18.804	113.535	18.858	116.055	18.916	118.578	18.983	121.104	19.059	123.633	19.144	126.165	19.238	128.699	19.341	131.236	19.453	133.776	19.574	136.318	19.703	250	
230	98.115	17.345	100.627	17.379	103.143	17.423	105.661	17.476	108.183	17.439	110.708	17.512	113.237	17.595	115.768	17.687	118.302	17.790	120.839	17.901	123.379	18.023	125.922	18.154	128.467	18.295	230	
200	86.300	15.008	88.814	15.047	91.332	15.097	93.853	15.159	96.378	15.231	98.907	15.315	101.439	15.410	103.974	15.517	106.513	15.634	109.055	15.763	111.600	15.902	114.148	16.053	116.699	16.215	200	
170	74.486	12.773	77.002	12.819	79.523	12.878	82.048	12.951	84.577	13.036	87.110	13.135	89.647	13.247	92.188	13.372	94.733	13.510	97.281	13.661	99.833	13.825	102.388	14.002	104.946	14.193	170	65 (P)*
155	68.599	11.657	71.097	11.707	73.620	11.772	76.147	11.852	78.678	11.946	81.214	12.054	83.755	12.176	86.299	12.313	88.847	12.465	91.399	12.631	93.955	12.811	96.515	13.005	99.077	13.214	155	
125	56.267	9.429	59.289	9.492	61.817	9.572	64.350	9.671	66.888	9.787	69.432	9.921	71.980	10.073	74.533	10.243	77.091	10.430	79.653	10.635	82.219	10.858	84.789	11.099	87.363	11.357	125	
100	46.927	7.579	49.453	7.658	51.987	7.758	54.527	7.881	57.074	8.027	59.627	8.194	62.185	8.384	64.748	8.596	67.317	8.830	69.890	9.086	72.468	9.364	75.049	9.663	77.635	9.985	100	
90	42.991	6.843	45.521	6.930	48.058	7.042	50.602	7.178	53.153	7.339	55.710	7.525	58.274	7.736	60.842	7.971	63.416	8.231	65.995	8.515	68.578	8.823	71.165	9.156	73.755	9.512	90	50 (P)*
80	39.057	6.109	41.590	6.207	44.131	6.332	46.680	6.486	49.236	6.667	51.799	6.877	54.368	7.113	56.943	7.377	59.523	7.669	62.108	7.988	64.697	8.334	67.289	8.707	69.885	9.107	80	50 (H)**
70	35.124	5.379	37.661	5.491	40.207	5.634	42.761	5.810	45.324	6.017	47.893	6.256	50.469	6.526	53.051	6.827	55.638	7.160	58.230	7.533	60.825	7.937	63.423	8.342	66.023	8.797	70	
60	31.192	4.655	33.735	4.785	36.287	4.953	38.849	5.157	41.419	5.399	43.997	5.677	46.581	5.991	49.170	6.342	51.764	6.728	54.362	7.150	56.963	7.608	59.566	8.100	62.169	8.627	60	40 (P)*
55	29.228	4.296	31.773	4.439	34.330	4.621	36.896	4.844	39.470	5.107	42.052	5.410	44.641	5.752	47.234	6.134	49.832	6.554	52.433	7.014	55.036	7.511	57.639	8.046	60.242	8.618	55	
50	27.264	3.941	29.813	4.097	32.374	4.298	34.945	4.543	37.525	4.832	40.112	5.164	42.704	5.540	45.302	5.959	47.903	6.420	50.506	6.923	53.109	7.467	55.712	8.052	58.313	8.677	50	40 (H)**
45	25.301	3.589	27.855	3.763	30.421	3.986	32.998	4.257	35.583	4.578	38.174	4.946	40.772	5.363	43.375	5.826	45.979	6.336	48.579	6.892	51.182	7.493	53.787	8.138	56.396	8.826	45	35 (P)*
40	23.340	3.243	25.899	3.438	28.471	3.669	31.054	3.994	33.645	4.354	36.242	4.767	38.843	5.233	41.446	5.752	44.049	6.322	46.650	6.942	49.248	7.612	51.838	8.330	54.421	9.095	40	35 (H) 30 (P)*
35	21.381	2.905	23.947	3.128	26.526	3.414	29.115	3.762	31.711	4.171	34.313	4.641	36.916	5.171	39.519	5.759	42.118	6.404	44.712	7.105	47.306	7.868	49.896	8.668	52.486	9.527	35	
33	20.398	2.773	23.167	3.009	25.749	3.312	28.341	3.680	30.939	4.114	33.542	4.611	36.145	5.171	38.747	5.792	41.342	6.473	43.930	7.212	46.506	8.007	49.068	8.857	51.614	9.759	33	
30	19.425	2.579	21.998	2.838	24.585	3.171	27.181	3.575	29.783	4.050	32.386	4.594	34.988	5.206	37.594	5.884	40.171	6.626	42.745	7.430	45.304	8.293	47.842	9.213	50.358	10.187	30	30 (H)**
25	17.473	2.271	20.056	2.582	22.651	2.979	25.253	3.461	27.856	4.026	30.455	4.671	33.045	5.394	35.621	6.191	38.177	7.060	40.716	7.997	43.243	8.997	45.762	10.058	48.274	11.174	25	
23	16.693	2.157	19.281	2.494	21.879	2.924	24.482	3.446	27.084	4.057	29.678	4.753	32.258	5.531	34.818	6.387	37.352	7.318	39.855	8.319	42.322	9.384	44.747	10.509			23	25 (P)*
20	15.527	1.997	18.121	2.363	20.723	2.876	23.325	3.411	25.919	4.165	28.497	4.953	31.050	5.830	33.572	6.791	36.055	7.830	38.492	8.939							20	25 (H)**
15	13.591	1.788	16.193	2.297	18.792	2.942	21.373	3.715	23.921	4.606	26.424	5.607	28.869	6.704													15	20 (P)*
14	13.205	1.759	15.808	2.303	18.402	2.990	20.972	3.811	23.500	4.754	25.974	5.808															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 43 Degrees

$\Delta = 43°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1024.817	187.080	1027.322	187.095	1029.828	187.111	1032.334	187.127	1034.840	187.145	1037.347	187.163	1039.854	187.182	1042.361	187.202	1044.869	187.223	1047.377	187.245	1049.885	187.268	1052.393	187.292	1054.902	187.317	2500	
2200	906.650	164.660	909.156	164.677	911.662	164.694	914.169	164.713	916.676	164.733	919.184	164.754	921.691	164.776	924.200	164.799	926.708	164.823	929.217	164.848	931.727	164.874	934.236	164.901	936.746	164.928	2200	
2000	827.872	149.716	830.379	149.734	832.886	149.754	835.393	149.774	837.901	149.796	840.410	149.819	842.918	149.844	845.427	149.868	847.937	149.895	850.447	149.922	852.957	149.951	855.468	149.980	853.978	150.011	2000	
1800	749.096	134.774	751.604	134.795	754.111	134.817	756.620	134.840	759.128	134.864	761.637	134.889	764.147	134.916	766.657	134.944	769.167	134.973	771.678	135.004	774.189	135.035	776.701	135.069	779.214	135.103	1800	
1500	630.934	112.370	633.443	112.395	635.953	112.421	638.463	112.449	640.973	112.478	643.484	112.508	645.995	112.541	648.507	112.574	651.020	112.609	653.532	112.646	656.046	112.684	658.560	112.723	661.075	112.764	1500	
1200	512.778	89.982	515.289	90.013	517.801	90.046	520.313	90.080	522.826	90.116	525.340	90.155	527.854	90.195	530.369	90.237	532.884	90.281	535.400	90.326	537.917	90.374	540.434	90.424	542.952	90.475	1200	
1000	434.013	75.073	436.526	75.110	439.040	75.149	441.555	75.190	444.070	75.234	446.586	75.280	449.103	75.328	451.621	75.378	454.139	75.431	456.658	75.486	459.178	75.543	461.699	75.602	464.220	75.664	1000	
900	394.633	67.626	397.148	67.667	399.663	67.711	402.179	67.757	404.696	67.805	407.214	67.856	409.733	67.909	412.252	67.965	414.773	68.024	417.294	68.085	419.816	68.148	422.339	68.214	424.862	68.283	900	
800	355.256	60.187	357.772	60.233	360.290	60.282	362.808	60.334	365.327	60.389	367.847	60.446	370.368	60.506	372.889	60.569	375.412	60.635	377.936	60.704	380.460	60.775	382.986	60.849	385.512	60.926	800	
700	315.883	52.760	318.401	52.813	320.921	52.869	323.441	52.927	325.963	52.990	328.486	53.055	331.010	53.124	333.534	53.196	336.060	53.271	338.587	53.350	341.115	53.431	343.643	53.516	346.173	53.604	700	
600	276.515	45.349	279.037	45.411	281.559	45.476	284.083	45.545	286.608	45.618	289.134	45.694	291.662	45.775	294.190	45.859	296.720	45.946	299.251	46.038	301.783	46.133	304.316	46.231	306.850	46.334	600	
500	237.157	37.966	239.682	38.040	242.209	38.118	244.737	38.201	247.267	38.288	249.798	38.380	252.330	38.476	254.864	38.577	257.399	38.682	259.935	38.792	262.473	38.906	265.012	39.024	267.552	39.147	500	
400	197.813	30.631	200.344	30.723	202.877	30.821	205.412	30.925	207.948	31.033	210.486	31.148	213.026	31.268	215.567	31.394	218.109	31.525	220.654	31.662	223.200	31.805	225.747	31.953	228.296	32.106	400	
360	182.083	27.719	184.617	27.821	187.153	27.930	189.691	28.045	192.231	28.166	194.773	28.293	197.316	28.427	199.861	27.567	202.408	28.713	204.956	28.865	207.507	29.023	210.058	29.187	212.612	29.358	360	100 (P)*
350	178.151	26.994	180.686	27.099	183.223	27.211	185.762	27.329	188.303	27.454	190.846	27.585	193.390	27.722	195.936	27.866	198.484	28.016	201.034	28.172	203.585	28.335	206.138	28.504	208.693	28.679	350	
300	158.489	23.991	161.040	23.513	163.582	23.644	166.127	23.782	168.673	23.927	171.222	24.080	173.773	24.240	176.325	24.407	178.880	24.582	181.436	24.765	183.995	24.954	186.555	25.151	189.116	25.356	300	
250	138.863	19.842	141.410	19.990	143.960	20.146	146.512	20.311	149.067	20.485	151.623	20.668	154.182	20.860	156.743	21.061	159.306	21.271	161.871	21.489	164.438	21.717	167.007	21.953	169.578	22.198	250	
230	131.015	18.446	133.566	18.606	136.119	18.776	138.675	18.955	141.233	19.145	143.794	19.343	146.356	19.552	148.921	19.770	151.489	19.998	154.058	20.235	156.629	20.482	159.203	20.738	161.778	21.004	230	80 (P)*
200	119.253	16.388	121.810	16.572	124.370	16.768	126.932	16.974	129.497	17.191	132.064	17.420	134.634	17.659	137.206	17.910	139.780	18.171	142.357	18.444	144.936	18.727	147.516	19.021	150.099	19.327	200	
170	107.508	14.396	110.072	14.613	112.640	14.842	115.210	15.084	117.783	15.340	120.359	15.608	122.937	15.889	125.518	16.183	128.101	16.490	130.685	16.810	133.272	17.142	135.861	17.488	138.452	17.846	170	
155	101.644	13.437	104.213	13.674	106.783	13.925	109.360	14.191	111.938	14.470	114.519	14.764	117.102	15.072	119.687	15.394	122.274	15.730	124.864	16.080	127.455	16.444	130.048	16.822	132.643	17.214	155	65 (P)*
125	89.940	11.633	92.520	11.926	95.104	12.237	97.690	12.565	100.279	12.910	102.870	13.273	105.464	13.653	108.059	14.051	110.656	14.465	113.255	14.896	115.855	15.345	118.456	15.810	121.058	16.292	125	
100	80.223	10.328	82.815	10.693	85.409	11.080	88.005	11.488	90.604	11.917	93.204	12.368	95.806	12.839	98.408	13.332	101.011	13.845	103.615	14.379	106.219	14.934	108.822	15.509	111.424	16.104	100	
90	76.349	9.893	78.945	10.297	81.544	10.725	84.144	11.177	86.746	11.652	89.348	12.150	91.952	12.672	94.555	13.216	97.159	13.783	99.761	14.373	102.363	14.985	104.964	15.619	107.562	16.275	90	50 (P)
80	72.483	9.534	75.084	9.987	77.686	10.466	80.289	10.972	82.892	11.503	85.496	12.060	88.099	12.643	90.701	13.251	93.301	13.884	95.899	14.541	98.495	15.223	101.086	15.929	103.677	16.659	80	50 (H)**
70	68.626	9.282	71.229	9.797	73.832	10.341	76.436	10.915	79.038	11.517	81.638	12.148	84.236	12.808	86.832	13.495	89.423	14.209	92.010	14.951	94.592	15.720	97.169	16.515	99.739	17.336	70	
60	64.772	9.189	67.375	9.784	69.976	10.413	72.574	11.074	75.168	11.769	77.758	12.495	80.342	13.252	82.920	14.041	85.491	14.859	88.053	15.708	90.607	16.585	93.151	17.491	95.684	18.425	60	40 (P)*
55	62.844	9.227	65.444	9.872	68.040	10.553	70.631	11.269	73.216	12.019	75.795	12.804	78.366	13.621	80.929	14.471	83.481	15.352	86.023	16.265	88.553	17.207	91.070	18.179	93.573	19.180	55	
50	60.911	9.342	63.504	10.046	66.091	10.788	68.671	11.567	71.242	12.383	73.804	13.234	76.355	14.120	78.894	15.040	81.419	15.993	83.930	16.978	86.425	17.994	88.904	19.040	91.365	20.113	50	40 (H)**
45	58.965	9.558	61.546	10.331	64.118	11.144	66.679	11.998	69.228	12.890	71.763	13.819	74.283	14.785	76.787	15.785	79.272	16.819	81.738	17.886	84.183	18.985	86.606	20.112	89.006	21.269	45	35 (P)*
40	56.994	9.906	59.554	10.762	62.101	11.661	64.631	12.602	67.144	13.583	69.637	14.602	72.109	15.659	74.559	16.752	76.983	17.878	79.382	19.036							40	30 (H)**
35	54.972	10.435	57.497	11.390	60.000	12.391	62.480	13.434	64.934	14.519	67.360	15.643															35	
33	54.139	10.711	56.643	11.712	59.121	12.758	61.572	13.848	63.993	14.978																	33	30 (P)*
30	52.848	11.213	55.309	12.288	57.737	13.408																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 44 Degrees

$\Delta = 44°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	1017.566	196.339	1020.067	196.343	1022.569	196.347	1025.071	196.351	1027.573	196.357	1030.075	196.364	1032.578	196.372	1035.082	196.380	1037.585	196.390	1040.089	196.400	1042.593	196.411	1045.097	196.424	1047.602	196.437	2500	
2200	896.359	172.780	898.860	172.783	901.362	172.788	903.864	172.793	906.366	172.800	908.869	172.808	911.372	172.816	913.876	172.826	916.380	172.837	918.884	172.849	921.389	172.861	923.894	172.875	926.400	172.890	2200	
2000	815.553	157.073	818.055	157.077	820.557	157.082	823.059	157.089	825.562	157.096	828.065	157.104	830.569	157.114	833.073	157.124	835.577	157.136	838.082	157.149	840.587	157.163	843.093	157.178	845.599	157.195	2000	
1800	734.749	141.367	737.250	141.371	739.752	141.377	742.255	141.384	744.758	141.392	747.261	141.401	749.765	141.412	752.270	141.424	754.775	141.437	757.280	141.451	759.786	141.467	762.292	141.484	764.799	141.502	1800	
1600	653.941	117.808	616.043	117.813	618.546	117.820	621.049	117.828	623.552	117.838	626.057	117.849	628.561	117.862	631.067	117.876	633.573	117.892	637.079	117.909	638.586	117.928	641.093	117.948	643.601	117.970	1600	
1400	492.334	94.249	494.837	94.256	497.340	94.264	499.844	94.275	502.348	94.287	504.853	94.301	507.359	94.317	509.866	94.335	512.373	94.354	514.881	94.376	517.390	94.399	519.899	94.423	522.409	94.452	1400	
1200	411.530	78.544	414.032	78.552	416.536	78.562	419.041	78.575	421.546	78.589	424.052	78.606	426.560	78.625	429.067	78.646	431.576	78.670	434.085	78.696	436.596	78.724	439.107	78.754	441.619	78.787	1200	
1000	371.127	70.692	373.631	70.701	376.135	70.712	378.640	70.726	381.146	70.742	383.653	70.760	386.161	70.782	388.669	70.805	391.179	70.832	393.689	70.861	396.201	70.892	398.713	70.925	401.226	70.962	1000	
900	330.725	62.940	333.229	62.950	335.734	62.962	338.239	62.978	340.746	62.996	343.254	63.017	345.763	62.941	348.272	62.968	350.783	62.997	353.295	63.030	355.808	63.064	358.322	63.103	360.836	63.143	900	
800	290.323	54.988	292.828	55.000	295.333	55.014	297.839	55.031	300.347	55.053	302.856	55.077	305.366	55.104	307.877	55.134	310.389	55.168	312.903	55.205	315.417	55.245	317.933	55.289	320.450	55.335	800	100 (P)*
700	249.922	47.137	252.427	47.150	254.933	47.167	257.440	47.188	259.949	47.212	262.460	47.240	264.971	47.272	267.484	47.308	269.999	47.347	272.514	47.390	275.031	47.437	277.549	47.488	280.068	47.542	700	
600	209.520	39.287	212.026	39.303	214.534	39.323	217.043	39.348	219.553	39.377	222.066	39.411	224.580	39.449	227.095	39.492	229.612	39.539	232.131	39.591	234.651	39.647	237.172	39.707	239.695	39.773	600	
500	169.120	31.439	171.627	31.459	174.136	31.484	176.648	31.515	179.161	31.551	181.676	31.594	184.193	31.641	186.712	31.695	189.233	31.753	191.756	31.818	194.281	31.888	196.808	31.964	199.336	32.045	500	
450	152.980	28.301	155.468	28.322	157.978	28.350	160.491	28.385	163.005	28.425	165.522	28.472	168.041	28.525	170.562	28.584	173.085	28.650	175.611	28.721	178.138	28.800	180.667	28.884	183.199	28.974	450	
400	148.920	27.516	151.428	27.538	153.939	27.567	156.451	27.603	158.966	27.644	161.484	27.692	164.003	27.747	166.525	27.808	169.049	27.875	171.575	27.949	174.103	28.029	176.633	28.116	179.165	28.209	400	
360	128.720	23.594	131.230	23.620	133.742	23.654	136.257	23.695	138.775	23.744	141.295	23.800	143.817	23.864	146.342	23.935	148.870	24.013	151.400	24.099	153.932	24.193	156.467	24.294	159.004	24.402	360	80 (P)*
320	108.521	19.674	111.033	19.705	113.548	19.746	116.065	19.795	118.586	19.854	121.110	19.921	123.637	19.997	126.166	20.083	128.699	20.177	131.234	20.280	133.772	20.393	136.313	20.514	138.857	20.644	320	
280	100.442	18.107	102.955	18.141	105.470	18.185	107.990	18.239	110.512	18.302	113.038	18.375	115.567	18.458	118.099	18.551	120.634	18.654	123.172	18.766	125.713	18.888	128.257	19.019	130.804	19.161	280	
240	88.324	15.757	90.838	15.797	93.356	15.847	95.878	15.909	98.404	15.982	100.933	16.066	103.466	16.162	106.002	16.268	108.542	16.386	111.085	16.515	113.632	16.655	116.181	16.807	118.734	16.969	240	
200	76.206	13.410	78.723	13.457	81.244	13.516	83.770	13.589	86.299	13.674	88.834	13.774	91.372	13.886	93.914	14.011	96.460	14.150	99.009	14.301	101.563	14.466	104.119	14.644	106.680	14.835	200	65 (P)*
195	70.148	12.238	72.666	12.289	75.189	12.354	77.717	12.434	80.250	12.528	82.787	12.636	85.328	12.759	87.874	12.897	90.423	13.049	92.977	13.215	95.535	13.396	98.096	13.591	100.661	13.800	195	
180	58.033	9.898	60.555	9.961	63.083	10.041	65.617	10.140	68.157	10.257	70.701	10.391	73.251	10.544	75.806	10.714	78.366	10.902	80.930	11.108	83.498	11.332	86.070	11.573	88.646	11.833	180	
160	47.939	7.955	50.467	8.033	53.001	8.134	55.543	8.258	58.091	8.403	60.645	8.571	63.205	8.762	65.771	8.974	68.341	9.209	70.917	9.466	73.497	9.745	76.081	10.046	78.670	10.369	160	
140	43.903	7.180	46.433	7.268	48.971	7.380	51.517	7.517	54.069	7.679	56.628	7.866	59.193	8.077	61.764	8.313	64.341	8.573	66.922	8.859	69.508	9.168	72.098	9.502	74.692	9.859	140	50 (P)*
120	39.867	6.409	42.401	6.507	44.943	6.634	47.494	6.788	50.052	6.970	52.616	7.180	55.188	7.417	57.765	7.682	60.348	7.975	62.936	8.295	65.528	8.642	68.124	9.017	70.723	9.418	120	50 (H)**
100	35.833	5.642	38.371	5.754	40.919	5.898	43.475	6.074	46.039	6.282	48.611	6.522	51.190	6.793	53.774	7.095	56.364	7.429	58.956	7.793	61.552	8.189	64.150	8.613	66.753	9.072	100	
90	31.801	4.880	34.344	5.011	36.899	5.179	39.462	5.385	42.035	5.627	44.615	5.906	47.202	6.221	49.795	6.573	52.393	6.961	54.994	7.384	57.599	7.844	60.207	8.338	62.815	8.867	90	40 (P)*
80	29.786	4.503	32.333	4.646	34.891	4.829	37.459	5.053	40.036	5.317	42.621	5.621	45.213	5.964	47.810	6.347	50.412	6.769	53.017	7.230	55.624	7.729	58.233	8.266	60.841	8.840	80	
70	27.771	4.129	30.322	4.286	32.885	4.487	35.458	4.733	38.041	5.023	40.631	5.357	43.227	5.734	45.829	6.154	48.434	6.616	51.041	7.121	53.650	7.667	56.259	8.254	58.865	8.882	70	40 (H)**
65	25.758	3.759	28.314	3.933	30.882	4.156	33.461	4.429	36.049	4.751	38.645	5.127	41.246	5.538	43.851	6.005	46.459	6.515	49.068	7.073	51.676	7.676	54.285	8.323	56.893	9.014	65	35 (P)*
60	23.747	3.394	26.308	3.590	28.883	3.841	31.468	4.147	34.062	4.508	36.663	4.923	39.268	5.391	41.877	5.911	44.485	6.483	47.092	7.106	49.698	7.778	52.293	8.498	54.883	9.266	60	35 (H) 30 (P)*
55	21.737	3.037	24.306	3.261	26.887	3.548	29.480	3.897	32.080	4.308	34.686	4.779	37.294	5.311	39.905	5.901	42.508	6.548	45.108	7.252	47.700	8.009	50.281	8.820	52.848	9.682	55	
50	20.935	2.897	23.506	3.135	26.091	3.438	28.686	3.808	31.289	4.243	33.896	4.742	36.505	5.304	39.112	5.927	41.714	6.610	44.308	7.352	46.892	8.130	49.462	9.003	52.016	9.908	50	
45	19.731	2.692	22.307	2.953	24.897	3.286	27.497	3.692	30.103	4.169	32.712	4.715	35.319	5.329	37.922	6.009	40.516	6.754	43.098	7.560	45.664	8.426	48.211	9.349	50.736	10.327	45	30 (H)**
40	17.729	2.367	20.315	2.678	22.914	3.077	25.521	3.561	28.129	4.127	30.735	4.775	33.331	5.500	35.915	6.300	38.479	7.172	41.020	8.112	43.533	9.116	46.012	10.186	48.455	11.300	40	
35	16.930	2.244	19.521	2.583	22.123	3.015	24.731	3.538	27.339	4.151	29.939	4.849	32.526	5.630	35.094	6.490	37.637	7.424	40.150	8.428	42.627	9.497	45.062	10.626			35	25 (P)*
30	15.734	2.074	18.331	2.461	20.938	2.956	23.546	3.553	26.147	4.249	28.732	5.040	31.293	5.921	33.824	6.885	36.317	7.927	38.764	9.040							30	25 (H)**
25	13.749	1.846	16.356	2.358	18.961	3.005	21.549	3.780	24.106	4.675	26.618	5.678	29.073	6.780													25	20 (P)*
24	13.353	1.814	15.961	2.360	18.562	3.050	21.139	3.873	23.677	4.819	26.160	5.877															24	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 44 Degrees

$\Delta = 44°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1050.107	196.450	1052.613	196.465	1055.119	196.481	1057.625	196.498	1060.131	196.515	1062.638	196.534	1065.145	196.553	1067.653	196.573	1070.160	196.594	1072.669	196.616	1075.177	196.639	1077.686	196.663	1080.195	196.688	2500	
2200	928.905	172.906	931.412	172.923	933.918	172.940	936.425	172.959	938.933	172.979	941.440	173.000	943.948	173.022	946.457	173.045	948.966	173.069	951.475	173.094	953.984	173.120	956.494	173.147	959.004	173.175	2200	
2000	848.105	157.212	850.612	157.231	853.119	157.250	855.627	157.271	858.135	157.293	860.643	157.316	863.152	157.340	865.662	157.365	868.171	157.392	870.681	157.419	873.192	157.448	875.703	157.478	878.214	157.509	2000	
1800	767.306	141.521	769.813	141.542	772.321	141.564	774.830	141.587	777.339	141.611	779.848	141.636	782.358	141.663	784.868	141.692	787.379	141.721	789.890	141.751	792.402	141.783	794.914	141.816	797.426	141.851	1800	
1600	646.110	117.993	648.619	118.018	651.128	118.044	653.639	118.072	656.149	118.101	658.660	118.131	661.172	118.164	663.684	118.198	666.197	118.232	668.710	118.269	671.224	118.308	673.739	118.347	676.254	118.388	1600	
1400	524.919	94.480	527.431	94.512	529.942	94.544	532.455	94.579	534.968	94.613	537.482	94.654	539.997	94.694	542.512	94.736	545.028	94.780	547.545	94.826	550.062	94.874	552.580	94.923	555.098	94.975	1400	
1200	444.131	78.822	446.645	78.859	449.159	78.898	451.674	78.940	454.190	78.984	456.707	79.030	459.224	79.078	461.742	79.128	464.261	79.181	466.781	79.236	469.301	79.293	471.822	79.353	474.344	79.415	1200	
1000	403.790	71.000	406.255	71.042	408.771	71.085	411.288	71.131	413.805	71.180	416.323	71.231	418.843	71.285	421.363	71.341	423.884	71.400	426.406	71.461	428.928	71.524	431.451	71.591	433.976	71.659	1000	
800	363.352	63.187	365.869	63.233	368.386	63.282	370.905	63.334	373.425	63.389	375.945	63.447	378.467	63.507	380.989	63.570	383.512	63.636	386.037	63.705	388.562	63.776	391.088	63.851	393.615	63.928	800	
700	322.968	55.345	325.487	55.437	328.007	55.494	330.528	55.553	333.050	55.616	335.573	55.681	338.098	55.750	340.623	55.823	343.150	55.898	345.677	55.977	348.206	56.059	350.735	56.144	353.266	56.232	700	
600	282.589	47.600	285.111	47.662	287.634	47.727	290.159	47.796	292.685	47.869	295.211	47.946	297.740	48.027	300.269	48.111	302.800	48.199	305.331	48.290	307.864	48.386	310.398	48.485	312.933	48.588	600	
500	242.220	39.842	244.746	39.916	247.273	39.995	249.802	40.078	252.333	40.166	254.865	40.258	257.398	40.354	259.933	40.455	262.469	40.561	265.006	40.670	267.545	40.783	270.085	40.904	272.627	41.027	500	
400	201.866	32.133	204.398	32.225	206.932	32.323	209.468	32.427	212.005	32.536	214.544	32.652	217.085	32.772	219.627	32.898	222.171	33.030	224.717	33.167	227.264	33.311	229.813	33.459	232.363	33.613	400	
360	181.732	29.071	184.267	29.174	186.804	29.283	189.344	29.398	191.884	29.520	194.427	29.647	196.972	29.781	199.518	29.922	202.067	30.068	204.616	30.220	207.168	30.380	209.721	30.544	212.276	30.716	360	100 (P)*
320	161.699	25.308	164.235	25.414	166.774	25.526	169.314	25.643	171.856	25.770	174.400	28.901	176.945	29.039	179.493	29.184	182.042	29.334	184.593	25.897	187.053	26.088	189.615	26.285	192.179	26.491	320	
300	151.543	24.519	154.084	24.642	156.628	24.772	159.174	24.911	161.722	25.057	164.272	25.210	166.824	25.371	169.379	25.539	171.935	25.714	174.493	25.897	177.053	26.088	179.615	26.285	182.179	26.491	300	
280	141.403	20.783	143.952	20.931	146.503	21.088	149.056	21.254	151.612	21.428	154.171	21.612	156.731	21.805	159.294	22.006	161.859	22.217	164.426	22.436	166.996	22.664	169.567	22.901	172.140	23.147	280	
260	133.354	19.312	135.906	19.473	138.461	19.643	141.018	19.824	143.578	20.013	146.140	20.213	148.705	20.422	151.272	20.641	153.842	20.870	156.413	21.108	158.987	21.355	161.562	21.613	164.140	21.880	260	80 (P)*
240	121.290	17.143	123.848	17.328	126.410	17.524	128.974	17.731	131.541	17.949	134.111	18.178	136.683	18.418	139.257	18.670	141.834	18.932	144.413	19.205	146.994	19.490	149.577	19.785	152.163	20.092	240	
220	109.343	15.039	111.810	15.256	114.380	15.487	116.952	15.730	119.528	15.986	122.106	16.255	124.687	16.537	127.270	16.833	129.856	17.141	132.444	17.461	135.034	17.795	137.626	18.141	140.220	18.501	220	
200	103.229	14.024	105.800	14.262	108.375	14.514	110.953	14.781	113.533	15.061	116.116	15.356	118.702	15.665	121.291	15.988	123.881	16.326	126.474	16.677	129.069	17.042	131.666	17.421	134.264	17.814	200	65 (P)*
175	91.226	12.109	93.809	12.404	96.395	12.715	98.985	13.045	101.577	13.391	104.172	13.755	106.769	14.137	109.368	14.536	111.969	14.951	114.572	15.384	117.176	15.834	119.781	16.301	122.388	16.785	175	
150	81.261	10.713	83.856	11.079	86.454	11.467	89.055	11.877	91.657	12.307	94.262	12.759	96.868	13.233	99.475	13.727	102.083	14.242	104.692	14.778	107.300	15.335	109.909	15.912	112.517	16.509	150	
130	72.288	10.241	79.889	10.647	82.492	11.077	85.096	11.530	87.702	12.007	90.310	12.507	92.918	13.030	95.527	13.576	98.135	14.145	100.744	14.737	103.351	15.351	105.958	15.988	108.562	16.646	130	50 (P)
120	73.326	9.846	75.930	10.301	78.537	10.782	81.145	11.289	83.753	11.822	86.362	12.382	88.970	12.966	91.578	13.576	94.185	14.211	96.789	14.871	99.391	15.555	101.991	16.264	104.587	16.997	120	50 (H)**
110	69.372	9.559	71.980	10.075	74.588	10.621	77.197	11.197	79.805	11.802	82.411	12.435	85.016	13.096	87.617	13.786	90.216	14.503	92.810	15.248	95.399	16.019	97.983	16.817	100.561	17.640	110	
100	65.424	9.430	68.032	10.027	70.638	10.658	73.243	11.322	75.843	12.019	78.440	12.747	81.031	13.508	83.617	14.299	86.195	15.120	88.766	15.972	91.328	16.852	93.880	17.762	96.423	18.699	100	40 (P)*
90	63.449	9.451	66.054	10.098	68.657	10.782	71.255	11.500	73.847	12.253	76.433	13.040	79.012	13.860	81.583	14.713	84.143	15.598	86.693	16.513	89.232	17.459	91.758	18.435	94.271	19.439	90	
80	61.469	9.549	64.069	10.255	66.663	11.000	69.250	11.782	71.829	12.600	74.399	13.455	76.958	14.344	79.506	15.267	82.040	16.223	84.560	17.212	87.065	18.231	89.554	19.281	92.025	20.360	80	40 (H)**
70	59.478	9.748	62.067	10.524	64.646	11.340	67.216	12.196	69.773	13.091	72.317	14.024	74.846	14.993	77.359	15.997	79.854	17.035	82.330	18.106	84.785	19.208	87.219	20.340	89.630	21.500	70	35 (P)*
60	57.463	10.080	60.032	10.939	62.587	11.841	65.126	12.785	67.648	13.770	70.151	14.793	72.633	15.853	75.093	16.950	77.528	18.080	79.937	19.242							60	30 (H)**
50	55.400	10.593	57.933	11.552	60.446	12.556	62.936	13.603	65.400	14.692	67.837	15.820															50	
45	54.351	10.864	57.063	11.868	59.551	12.918	62.013	14.011	64.444	15.146																	45	30 (P)*
40	53.236	11.357	55.707	12.435	58.146	13.560																					40	30 (H)**
35																											35	
30																											30	25 (P)*
25																											25	
23																											23	20 (H)**
20																											20	15 (H)**
15																											15	10 (P)*
14																											14	10 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 45°$

Deviation Angle = 45 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1043.035	205.983	1045.536	205.987	1048.037	205.991	1050.539	205.995	1053.042	206.001	1055.544	206.008	1058.047	206.016	1060.550	206.024	1063.054	206.034	1065.558	206.044	1068.062	206.055	1070.567	206.068	1073.072	206.081	2500	
2200	918.771	181.266	921.272	181.270	923.774	181.274	926.276	181.280	928.779	181.287	931.282	181.295	933.785	181.303	936.289	181.313	938.793	181.324	941.297	181.335	943.802	181.348	946.307	181.362	948.813	181.377	2200	
2000	835.928	164.789	838.430	164.792	840.932	164.797	843.434	164.804	845.937	164.811	848.440	164.820	850.944	164.829	853.448	164.840	855.952	164.852	858.457	164.865	860.963	164.879	863.469	164.894	865.975	164.910	2000	
1800	753.086	148.311	755.588	148.315	758.090	148.321	760.593	148.328	763.095	148.336	765.599	148.345	768.103	148.356	770.608	148.368	773.113	148.381	775.618	148.395	778.124	148.411	780.630	148.428	783.137	148.446	1800	
1500	628.823	123.594	631.324	123.600	633.827	123.606	636.330	123.615	638.834	123.624	641.338	123.636	643.843	123.648	646.348	123.663	648.854	123.678	651.361	123.696	653.868	123.715	656.375	123.735	658.884	123.757	1500	
1200	504.559	98.879	507.062	98.885	509.565	98.894	512.069	98.904	514.573	98.916	517.079	98.930	519.585	98.946	522.092	98.964	524.599	98.984	527.107	99.005	529.616	99.029	532.125	99.054	534.635	99.082	1200	
1000	421.717	82.402	424.220	82.410	426.724	82.420	429.229	82.432	431.734	82.447	434.241	82.464	436.748	82.483	439.256	82.505	441.765	82.528	444.274	82.554	446.785	82.582	449.296	82.613	451.809	82.646	1000	
900	380.296	74.164	382.800	74.173	385.304	74.184	387.809	74.198	390.315	74.214	392.822	74.233	395.330	74.254	397.839	74.278	400.349	74.304	402.860	74.333	405.371	74.364	407.884	74.398	410.398	74.435	900	
800	338.875	65.926	341.379	65.936	343.884	65.948	346.390	65.964	348.897	65.982	351.405	66.003	353.914	66.028	356.424	66.054	358.935	66.084	361.447	66.116	363.960	66.151	366.474	66.189	368.989	66.230	800	
700	297.455	57.689	299.959	57.700	302.464	57.714	304.971	57.732	307.479	57.753	309.988	57.777	312.499	57.805	315.010	57.835	317.522	57.869	320.036	57.906	322.551	57.946	325.067	57.990	327.584	58.037	700	100 (P)*
600	256.034	49.452	258.539	49.465	261.046	49.482	263.553	49.503	266.063	49.527	268.573	49.555	271.085	49.587	273.598	49.623	276.113	49.662	278.629	49.706	281.146	49.753	283.665	49.803	286.185	49.858	600	
500	214.614	41.216	217.120	41.232	219.628	41.252	222.137	41.277	224.648	41.306	227.161	41.340	229.675	41.378	232.191	41.421	234.708	41.469	237.227	41.521	239.748	41.577	242.270	41.638	244.794	41.703	500	
400	173.195	32.982	175.702	33.002	178.212	33.027	180.723	33.058	183.237	33.095	185.753	33.137	188.270	33.185	190.790	33.239	193.311	33.298	195.835	33.363	198.360	33.433	200.888	33.509	203.417	33.591	400	
360	156.627	29.689	159.136	29.711	161.646	29.739	164.159	29.774	166.674	29.814	169.191	29.861	171.711	29.915	174.233	29.974	176.756	30.040	179.282	30.112	181.810	30.190	184.341	30.275	186.873	30.365	360	
300	152.486	28.866	154.994	28.889	157.505	28.918	160.018	28.953	162.534	28.995	165.051	29.043	167.571	29.098	170.094	29.159	172.618	29.227	175.145	29.301	177.674	29.382	180.204	29.468	182.738	29.562	300	80 (P)*
240	131.777	24.751	134.287	24.778	136.799	24.812	139.314	24.853	141.832	24.902	144.353	24.958	146.876	25.022	149.402	25.093	151.930	25.172	154.461	25.259	156.994	25.353	159.530	25.454	162.068	25.562	240	
230	111.069	20.638	113.580	20.670	116.095	20.711	118.614	20.760	121.135	20.819	123.659	20.886	126.187	20.963	128.718	21.049	131.251	21.143	133.787	21.247	136.327	21.360	138.868	21.481	141.413	21.612	230	
200	102.786	18.994	105.298	19.029	107.815	19.071	110.334	19.127	112.858	19.190	115.384	19.264	117.914	19.347	120.447	19.440	122.983	19.543	125.522	19.656	128.064	19.778	130.609	19.910	133.158	20.052	200	
180	90.362	16.529	92.876	16.569	95.395	16.619	97.917	16.681	100.444	16.755	102.974	16.839	105.508	16.935	108.045	17.042	110.586	17.160	113.131	17.290	115.678	17.430	118.229	17.582	120.784	17.745	180	65 (P)*
170	77.939	14.066	80.456	14.113	82.977	14.172	85.504	14.245	88.034	14.331	90.569	14.431	93.109	14.543	95.652	14.669	98.199	14.808	100.750	14.961	103.305	15.126	105.864	15.305	108.426	15.496	170	
155	71.728	12.836	74.246	12.887	76.770	12.953	79.299	13.033	81.832	13.127	84.370	13.236	86.913	13.359	89.459	13.497	92.011	13.650	94.566	13.817	97.125	13.998	99.688	14.194	102.255	14.404	155	
125	59.307	10.380	61.830	10.443	64.359	10.524	66.894	10.624	69.434	10.741	71.980	10.876	74.532	11.029	77.088	11.200	79.649	11.388	82.215	11.595	84.786	11.820	87.360	12.062	89.939	12.322	125	
100	48.959	8.341	51.487	8.420	54.023	8.521	56.565	8.645	59.115	8.791	61.670	8.960	64.232	9.151	66.800	9.364	69.373	9.600	71.951	9.858	74.534	10.137	77.121	10.439	79.712	10.763	100	
90	44.821	7.528	47.352	7.616	49.891	7.728	52.438	7.866	54.992	8.028	57.553	8.216	60.120	8.428	62.693	8.665	65.272	8.926	67.856	9.212	70.445	9.523	73.038	9.857	75.635	10.217	90	50 (P)*
80	40.683	6.718	43.218	6.817	45.762	6.943	48.313	7.098	50.873	7.281	53.440	7.491	56.014	7.730	58.593	7.996	61.179	8.289	63.770	8.611	66.365	8.959	68.965	9.335	71.568	9.738	80	50 (H)**
70	36.548	5.913	38.982	6.025	41.636	6.170	44.194	6.346	46.760	6.555	49.334	6.795	51.915	7.067	54.503	7.371	57.096	7.706	59.694	8.075	62.297	8.469	64.903	8.896	67.512	9.355	70	
60	32.414	5.113	34.958	5.244	37.514	5.413	40.080	5.618	42.655	5.861	45.237	6.141	47.827	6.458	50.423	6.811	53.025	7.200	55.631	7.625	58.240	8.086	60.852	8.582	63.465	9.113	60	40 (P)*
55	30.348	4.716	32.896	4.859	35.456	5.043	38.026	5.268	40.606	5.532	43.194	5.837	45.788	6.182	48.389	6.566	50.995	6.990	53.604	7.452	56.216	7.943	58.830	8.492	61.444	9.068	55	
50	28.283	4.322	30.835	4.480	33.400	4.682	35.975	4.929	38.560	5.220	41.154	5.555	43.754	5.933	46.359	6.355	48.969	6.819	51.581	7.325	54.195	7.874	56.809	8.463	59.421	9.093	50	40 (H)**
45	26.219	3.933	28.776	4.108	31.347	4.332	33.928	4.606	36.519	4.929	39.118	5.300	41.723	5.719	44.333	6.186	46.946	6.699	49.560	7.259	52.173	7.864	54.785	8.514	57.395	9.207	45	35 (P)*
40	24.157	3.549	26.720	3.746	29.297	3.998	31.885	4.305	34.482	4.667	37.087	5.084	39.697	5.553	42.310	6.075	44.924	6.649	47.537	7.274	50.147	7.949	52.751	8.672	55.349	9.442	40	35 (H) 30 (P)*
35	22.097	3.173	24.667	3.398	27.251	3.685	29.847	4.036	32.451	4.448	35.062	4.922	37.675	5.455	40.289	6.047	42.900	6.693	45.507	7.403	48.106	8.165	50.694	8.977	53.290	9.842	35	
33	21.274	3.026	23.847	3.264	26.435	3.569	29.034	3.940	31.641	4.376	34.253	4.877	36.867	5.441	39.479	6.066	42.088	6.752	44.689	7.496	47.281	8.297	49.859	9.153	52.421	10.061	33	
30	20.040	2.809	22.619	3.071	25.212	3.406	27.815	3.813	30.426	4.291	33.040	4.839	35.653	5.456	38.262	6.138	40.863	6.885	43.452	7.694	46.027	8.564	48.583	9.490	51.117	10.471	30	30 (H)**
25	17.988	2.464	20.577	2.777	23.180	3.177	25.791	3.663	28.404	4.231	31.016	4.881	33.630	5.609	36.210	6.412	38.783	7.287	41.333	8.330	43.855	9.536	46.365	10.806	48.796	11.930	25	
23	17.169	2.335	19.762	2.672	22.369	3.108	24.982	3.633	27.595	4.248	30.202	4.949	32.797	5.733	35.373	6.595	37.925	7.533	40.447	8.540	42.933	9.613	45.380	10.746			23	25 (P)*
20	15.942	2.153	18.544	2.542	21.155	3.038	23.769	3.637	26.376	4.336	28.968	5.130	31.538	6.013	34.078	6.981	36.580	8.027	39.038	9.144							20	25 (H)**
15	13.908	1.906	16.520	2.420	19.131	3.069	21.726	3.847	24.291	4.745	26.813	5.752	29.279	6.858													15	20 (P)*
14	13.502	1.871	16.116	2.419	18.723	3.111	21.308	3.937	23.855	4.887	26.348	5.948															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 45 Degrees

$\triangle = 45°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1075.577	206.095	1078.083	206.110	1080.589	206.125	1083.095	206.142	1085.601	206.160	1088.108	206.178	1090.616	206.198	1093.124	206.218	1095.631	206.239	1098.140	206.261	1100.648	206.284	1103.157	206.308	1105.667	206.333	2500	
2200	951.319	181.393	953.825	181.410	956.332	181.428	958.839	181.447	961.347	181.467	963.855	181.488	966.363	181.510	968.872	181.533	971.381	181.557	973.890	181.582	976.400	181.608	978.910	181.635	981.420	181.664	2200	
2000	868.481	164.928	870.988	164.947	873.496	164.966	876.003	164.987	878.512	165.009	881.021	165.032	883.530	165.056	886.039	165.082	888.549	165.108	891.059	165.136	893.570	165.165	896.081	165.194	898.593	165.225	2000	
1800	785.645	148.466	788.152	148.486	790.660	148.508	793.169	148.531	795.678	148.556	798.188	148.581	800.698	148.608	803.209	148.636	805.720	148.666	808.231	148.697	810.743	148.729	813.255	148.762	815.768	148.796	1800	
1500	661.393	123.780	663.902	123.805	666.412	123.831	668.922	123.859	671.433	123.888	673.945	123.919	676.457	123.951	678.969	123.985	681.482	124.021	683.996	124.057	686.510	124.096	689.025	124.135	691.540	124.177	1500	
1200	537.146	99.111	539.658	99.142	542.170	99.175	544.683	99.209	547.197	99.246	549.711	99.284	552.226	99.325	554.742	99.367	557.258	99.411	559.775	99.457	562.292	99.505	564.811	99.555	567.330	99.607	1200	
1000	454.322	82.680	456.835	82.718	459.350	82.757	461.865	82.799	464.382	82.843	466.899	82.889	469.417	82.938	471.935	82.988	474.455	83.041	476.975	83.096	479.496	83.154	482.018	83.214	484.540	83.275	1000	
900	412.912	74.473	415.427	74.515	417.944	74.558	420.460	74.605	422.979	74.654	425.497	74.705	428.017	74.759	430.538	74.815	433.059	74.874	435.582	74.935	438.105	74.999	440.629	75.066	443.154	75.135	900	
800	371.505	66.274	364.022	66.321	376.541	66.370	379.060	66.422	381.580	66.477	384.101	66.535	386.623	66.595	389.146	66.659	391.670	66.725	394.195	66.794	396.721	66.866	399.248	66.941	401.775	67.018	800	
700	330.103	58.086	332.622	58.140	335.143	58.196	337.664	58.256	340.187	58.318	342.711	58.384	345.236	58.454	347.762	58.526	350.290	58.602	352.818	58.680	355.347	58.763	357.877	58.848	360.409	58.937	700	
600	288.706	49.916	291.229	49.978	293.752	50.044	296.278	50.113	298.804	50.187	301.332	50.263	303.861	50.344	306.391	50.429	308.922	50.517	311.455	50.609	313.989	50.705	316.523	50.804	319.060	50.907	600	
500	247.319	41.773	249.846	41.847	252.374	41.926	254.904	42.010	257.435	42.097	259.968	42.190	262.502	42.287	265.038	42.388	267.575	42.494	270.113	42.604	272.653	42.719	275.194	42.839	277.737	42.962	500	
400	205.948	33.678	208.481	33.771	211.016	33.869	213.552	33.974	216.090	34.083	218.631	34.199	221.172	34.320	223.716	34.447	226.261	34.579	228.808	34.717	231.357	34.860	233.907	35.010	236.495	35.164	400	
360	189.407	30.462	191.943	30.566	194.481	30.675	197.022	30.791	199.564	30.913	202.108	31.041	204.654	31.176	207.201	31.316	209.751	31.463	212.302	31.616	214.856	31.776	217.410	31.941	219.967	32.113	360	100 (P)*
350	185.273	29.661	187.810	29.768	190.349	29.880	192.890	29.999	195.433	30.125	197.979	30.257	200.526	30.395	203.074	30.540	205.625	30.691	208.178	30.848	210.732	31.012	213.289	31.182	215.847	31.359	350	
300	164.608	25.679	167.151	25.803	169.696	25.934	172.243	26.073	174.792	26.219	177.344	26.373	179.898	26.534	182.453	26.703	185.011	26.879	187.571	27.063	190.133	27.254	192.697	27.452	195.263	27.658	300	
250	143.961	21.751	146.511	21.900	149.063	22.057	151.618	22.224	154.176	22.399	156.736	22.584	159.299	22.777	161.863	22.979	164.430	23.190	167.000	23.410	169.571	23.639	172.145	23.877	174.720	24.124	250	
230	135.708	20.204	138.262	20.365	140.819	20.536	143.378	20.717	145.940	20.908	148.504	21.108	151.070	21.318	153.640	21.538	156.211	21.767	158.785	22.006	161.361	22.255	163.939	22.513	166.519	22.781	230	80 (P)*
200	123.341	17.919	125.901	18.105	128.465	18.302	131.031	18.509	133.600	18.728	136.171	18.958	138.746	19.200	141.322	19.452	143.902	19.715	146.483	19.993	149.067	20.275	151.654	20.571	154.242	20.879	200	
170	110.991	15.701	113.560	15.919	116.132	16.150	118.707	16.394	121.285	16.651	123.865	16.922	126.449	17.205	129.935	17.501	131.623	17.810	134.214	18.132	136.808	18.467	139.403	18.814	142.000	19.175	170	
155	104.825	14.628	107.399	14.867	109.976	15.120	112.556	15.388	115.139	15.670	117.726	15.965	120.314	16.276	122.906	16.600	125.499	16.938	128.096	17.291	130.694	17.657	133.294	18.038	135.896	18.432	155	65 (P)*
125	92.521	12.600	95.107	12.895	97.696	13.208	100.289	13.538	102.884	13.886	105.482	14.252	108.083	14.635	110.686	15.035	113.291	15.452	115.898	15.886	118.506	16.338	121.116	16.806	123.727	17.292	125	
100	82.307	11.109	84.906	11.477	87.507	11.866	90.111	12.277	92.718	12.709	95.327	13.163	97.937	13.638	100.549	14.134	103.162	14.651	105.776	15.188	108.390	15.747	111.004	16.326	113.618	16.926	100	
90	78.236	10.600	80.840	11.007	83.446	11.438	86.055	11.893	88.666	12.371	91.278	12.873	93.891	13.398	96.505	13.947	99.119	14.518	101.733	15.112	104.346	15.728	106.959	16.367	109.570	17.027	90	50 (P)
80	74.174	10.167	76.783	10.624	79.394	11.106	82.007	11.616	84.621	12.151	87.235	12.712	89.849	13.299	92.462	13.911	95.074	14.548	97.685	15.210	100.294	15.897	102.900	16.608	105.503	17.343	80	50 (H)**
70	70.123	9.843	72.736	10.362	75.350	10.910	77.964	11.487	80.578	12.094	83.190	12.730	85.801	13.394	88.409	14.086	91.014	14.805	93.615	15.552	96.212	16.327	98.803	17.127	101.389	17.954	70	
60	66.079	9.678	68.693	10.278	71.306	10.911	73.916	11.577	76.524	12.276	79.127	13.008	81.726	13.770	84.319	14.564	86.905	15.389	89.483	16.243	92.054	17.127	94.615	18.040	97.166	18.980	60	40 (P)*
55	64.058	9.681	66.669	10.331	69.278	11.017	71.883	11.738	74.482	12.494	77.076	13.283	79.663	14.107	82.241	14.962	84.810	15.850	87.369	16.769	89.917	17.718	92.452	18.697	94.974	19.705	55	
50	62.032	9.762	64.638	10.471	67.239	11.218	69.834	12.003	72.421	12.824	74.998	13.682	77.566	14.574	80.122	15.501	82.666	16.460	85.195	17.452	87.710	18.475	90.208	19.529	92.689	20.611	50	40 (H)**
45	59.995	9.944	62.591	10.722	65.179	11.542	67.756	12.401	70.322	13.299	72.874	14.235	75.413	15.208	77.935	16.215	80.440	17.257	82.926	18.331	85.391	19.437	87.836	20.573	90.258	21.738	45	35 (P)*
40	57.936	10.259	60.513	11.121	63.077	12.026	65.625	12.974	68.156	13.962	70.669	14.989	73.161	16.053	75.631	17.153	78.076	18.287	80.497	19.454							40	30 (H)**
35	55.831	10.756	58.373	11.718	60.895	12.726	63.395	13.777	65.869	14.870	68.317	16.001															35	
33	54.965	11.021	57.487	12.028	59.983	13.082	62.457	14.179	64.899	15.318																	33	30 (P)*
30	53.626	11.505	56.107	12.587	58.557	13.715																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P - Plain & Rolling Terrian **H - Mountainous & Steep Terrain

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 46 Degrees

$\Delta = 46°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	1068.688	215.904	1071.189	215.907	1073.691	215.911	1076.193	215.916	1078.695	215.922	1081.198	215.929	1083.700	215.937	1086.204	215.945	1088.708	215.955	1091.211	215.965	1093.716	215.976	1096.221	215.989	1098.726	216.002	2500	
2200	941.346	189.996	943.847	190.000	946.349	190.005	948.851	190.010	951.354	190.017	953.857	190.025	956.360	190.034	958.864	190.043	961.368	190.054	963.873	190.066	966.378	190.079	968.883	190.093	971.389	190.108	2200	
2000	856.451	172.725	858.952	172.729	861.454	172.734	863.957	172.740	866.460	172.748	868.963	172.756	871.467	172.766	873.971	172.776	876.475	172.788	878.980	172.801	881.486	172.816	883.992	172.831	886.498	172.847	2000	
1800	771.556	155.454	774.058	155.458	776.560	155.464	779.063	155.470	781.566	155.479	784.070	155.488	786.574	155.499	789.078	155.511	791.583	155.524	794.089	155.538	796.595	155.554	799.102	155.571	801.609	155.589	1800	
1500	644.214	129.547	646.717	129.552	649.219	129.559	651.722	129.567	654.226	129.577	656.730	129.588	659.235	129.601	661.741	129.615	664.247	129.631	666.754	129.649	669.261	129.667	671.769	129.688	674.277	129.710	1500	
1200	516.873	103.640	519.375	103.647	521.879	103.656	524.383	103.666	526.887	103.678	529.391	103.692	531.899	103.708	534.406	103.726	536.913	103.746	539.422	103.768	541.931	103.791	544.441	103.817	546.951	103.844	1200	
1000	431.979	86.370	434.481	86.378	436.986	86.388	439.460	86.401	441.996	86.416	444.502	86.432	447.010	86.452	449.518	86.473	452.027	86.497	454.537	86.523	457.048	86.551	459.560	86.582	462.072	86.615	1000	
900	389.531	77.735	392.035	77.744	394.539	77.756	397.044	77.769	399.551	77.785	402.058	77.804	404.566	77.826	407.075	77.850	409.586	77.876	412.097	77.905	414.609	77.937	417.122	77.970	419.635	78.007	900	
800	347.084	69.101	349.588	69.111	352.093	69.123	354.599	69.139	357.106	69.157	359.615	69.178	362.124	69.203	364.634	69.229	367.146	69.259	369.658	69.292	372.171	69.327	374.686	69.365	377.201	69.406	800	
700	304.638	60.467	307.142	60.478	309.648	60.492	312.155	60.510	314.663	60.531	317.172	60.555	319.683	60.583	322.194	60.614	324.707	60.647	327.221	60.685	329.736	60.725	332.253	60.769	334.771	60.816	700	100 (P)*
600	262.191	51.833	264.696	51.846	267.203	51.863	269.711	51.884	272.220	51.908	274.731	51.937	277.243	51.969	279.757	52.005	282.272	52.044	284.788	52.088	287.306	52.135	289.825	52.186	292.346	52.240	600	
500	219.745	43.200	222.251	43.216	224.759	43.237	227.269	43.261	229.780	43.291	232.293	43.325	234.807	43.363	237.324	43.406	239.841	43.454	242.361	43.506	244.882	43.563	247.405	43.624	249.929	43.689	500	
400	177.300	34.569	179.807	34.589	182.317	34.615	184.829	34.646	187.343	34.683	189.859	34.725	192.377	34.773	194.897	34.827	197.419	34.886	199.943	34.951	202.469	35.022	204.997	35.098	207.527	35.180	400	
360	160.322	31.118	162.830	31.140	165.341	31.168	167.854	31.203	170.370	31.244	172.887	31.291	175.407	31.344	177.930	31.404	180.454	31.470	182.981	31.542	185.509	31.621	188.040	31.705	190.574	31.797	360	
350	156.077	30.255	158.586	30.278	161.097	30.307	163.611	30.343	166.126	30.384	168.645	30.433	171.165	30.488	173.688	30.549	176.213	30.617	178.741	30.691	181.270	30.772	183.802	30.859	186.336	30.953	350	
300	134.855	25.942	137.366	25.969	139.879	26.002	142.394	26.044	144.913	26.093	147.434	26.149	149.958	26.214	152.484	26.285	155.013	26.361	157.544	26.451	160.079	26.545	162.615	26.647	165.154	26.756	300	80 (P)*
250	113.634	21.631	116.146	21.662	118.662	21.701	121.180	21.753	123.702	21.812	126.228	21.880	128.756	21.957	131.287	22.042	133.821	22.137	136.359	22.241	138.899	22.354	141.442	22.477	143.988	22.608	250	
230	105.146	19.907	107.659	19.942	110.176	19.986	112.696	20.040	115.220	20.104	117.747	20.178	120.278	20.261	122.811	20.355	125.349	20.458	127.889	20.571	130.432	20.694	132.979	20.826	135.528	20.969	230	
200	92.414	17.323	94.929	17.363	97.449	17.413	99.972	17.476	102.499	17.549	105.030	17.634	107.564	17.730	110.103	17.837	112.645	17.956	115.191	18.086	117.740	18.227	120.292	18.380	122.848	18.543	200	
170	79.684	14.741	82.201	14.788	84.723	14.848	87.250	14.921	89.782	15.007	92.318	15.107	94.858	15.220	97.403	15.346	99.951	15.486	102.504	15.639	105.010	15.805	107.620	15.984	110.184	16.176	170	65 (P)*
155	73.319	13.452	75.838	13.503	78.362	13.568	80.892	13.649	83.426	13.743	85.965	13.853	88.509	13.977	91.057	14.115	93.609	14.268	96.166	14.436	98.727	14.618	101.292	14.814	103.861	15.025	155	
125	60.590	10.876	63.114	10.940	65.644	11.021	68.179	11.121	70.721	11.238	73.268	11.374	75.821	11.527	78.379	11.699	80.942	11.889	83.510	12.096	86.083	12.321	88.659	12.564	91.240	12.825	125	
100	49.986	8.738	52.515	8.817	55.051	8.919	57.595	9.043	60.146	9.190	62.703	9.359	65.267	9.551	67.837	9.765	70.412	10.002	72.992	10.260	75.578	10.541	78.168	10.844	80.762	11.169	100	
90	45.745	7.886	48.277	7.973	50.817	8.087	53.366	8.225	55.921	8.388	58.484	8.576	61.053	8.789	63.628	9.026	66.210	9.289	68.797	9.576	71.388	9.887	73.985	10.224	76.586	10.584	90	50 (P)*
80	41.505	7.036	44.041	7.135	46.586	7.262	49.139	7.417	51.700	7.601	54.269	7.812	56.845	8.051	59.428	8.318	62.016	8.613	64.610	8.936	67.209	9.285	69.812	9.662	72.419	10.067	80	50 (H)**
70	37.267	6.191	39.807	6.304	42.358	6.449	44.917	6.626	47.486	6.836	50.062	7.077	52.646	7.350	55.236	7.654	57.832	7.991	60.434	8.358	63.040	8.756	65.651	9.186	68.264	9.646	70	
60	33.031	5.351	35.577	5.483	38.134	5.652	40.702	5.859	43.279	6.101	45.864	6.384	48.457	6.702	51.057	7.056	53.662	7.447	56.272	7.873	58.886	8.336	61.502	8.834	64.121	9.366	60	40 (P)*
55	30.914	4.935	33.464	5.079	36.025	5.263	38.598	5.489	41.180	5.754	43.770	6.060	46.368	6.406	48.973	6.792	51.583	7.217	54.196	7.681	56.813	8.184	59.432	8.725	62.052	9.303	55	
50	28.798	4.522	31.352	4.680	33.918	4.883	36.496	5.130	39.084	5.422	41.680	5.758	44.284	6.138	46.893	6.561	49.507	7.027	52.124	7.536	54.743	8.086	57.363	8.677	59.982	9.309	50	40 (H)**
45	26.683	4.112	29.242	4.288	31.814	4.513	34.398	4.788	36.992	5.112	39.595	5.484	42.204	5.905	44.818	6.373	47.436	6.889	50.055	7.450	52.674	8.059	55.292	8.710	57.907	9.406	45	35 (P)*
40	24.570	3.709	27.135	3.906	29.714	4.109	32.305	4.468	34.906	4.831	37.515	5.240	40.129	5.720	42.747	6.244	45.367	6.820	47.985	7.447	50.601	8.124	53.213	8.850	55.817	9.624	40	35 (H) 30 (P)*
35	22.459	3.313	25.031	3.538	27.118	3.827	30.217	4.179	32.825	4.593	35.440	5.068	38.059	5.603	40.678	6.198	43.296	6.850	45.909	7.558	48.515	8.322	51.111	9.138	53.695	15.006	35	
33	21.615	3.158	24.191	3.397	26.781	3.703	29.384	4.075	31.995	4.513	34.612	5.016	37.231	5.582	39.850	6.210	42.465	6.898	45.073	7.645	47.672	8.449	50.259	9.307	52.830	10.219	33	
30	20.351	2.930	22.932	3.192	25.528	3.528	28.136	3.937	30.751	4.417	33.370	4.967	35.989	5.586	38.604	6.271	41.213	7.020	43.810	7.833	46.392	8.705	48.957	9.635	51.501	10.620	30	30 (H)**
25	18.248	2.565	20.840	2.879	23.447	3.281	26.062	3.768	28.682	4.339	31.299	4.991	33.910	5.721	36.508	6.527	39.089	7.405	41.648	8.352	44.180	9.363	46.679	10.435	49.143	11.563	25	
23	17.408	2.427	20.006	2.768	22.616	3.203	25.234	3.731	27.853	4.348	30.467	5.051	33.069	5.838	35.653	6.704	38.214	7.645	40.746	8.656	43.243	9.733	45.700	10.870			23	25 (P)*
20	16.152	2.234	18.757	2.624	21.374	3.122	23.993	3.724	26.606	4.425	29.206	5.222	31.785	6.109	34.334	7.080	36.846	8.129	39.314	9.250							20	25 (H)**
15	14.068	1.968	16.685	2.483	19.302	3.135	21.905	3.916	24.479	3.817	27.010	5.828	29.486	6.938													15	20 (P)*
14	13.651	1.929	16.271	2.479	18.885	3.173	21.478	4.003	24.034	4.956	26.537	6.021															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 46 Degrees

$\Delta = 46°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1101.231	216.016	1102.737	216.031	1106.243	216.047	1108.750	216.063	1111.256	216.080	1113.763	216.100	1116.271	216.119	1118.779	216.139	1121.287	216.161	1123.795	216.183	1126.304	216.206	1128.813	216.230	1131.323	216.255	2500	
2200	973.895	190.124	976.401	190.140	978.908	190.158	981.416	190.177	983.924	190.198	986.431	190.219	988.940	190.241	991.449	190.264	993.958	190.288	996.468	190.313	998.978	190.340	1001.488	190.367	1003.999	190.395	2200	
2000	889.005	172.865	891.512	172.884	894.020	172.903	896.528	172.924	899.036	172.946	901.545	172.969	904.054	172.994	906.564	173.019	909.065	173.046	911.585	173.073	914.096	173.102	916.608	173.132	919.119	173.163	2000	
1800	804.116	155.679	806.624	155.630	809.133	155.652	811.642	155.675	814.151	155.699	816.661	155.725	819.171	155.752	821.682	155.781	824.193	155.810	826.705	155.841	829.217	155.873	831.730	155.906	834.243	155.941	1800	
1500	676.786	129.733	679.296	129.738	681.806	129.784	684.317	129.812	686.828	129.842	689.339	129.873	691.852	129.905	694.365	129.939	696.878	129.964	699.392	130.011	701.907	130.050	704.422	130.090	706.938	130.131	1500	
1200	549.462	103.873	551.974	103.905	554.487	103.937	557.000	103.972	559.514	104.009	562.029	104.048	564.544	104.088	567.060	104.131	569.577	104.175	572.094	104.221	574.612	104.269	577.131	104.319	579.650	104.371	1200	
1000	464.585	86.650	467.100	86.687	469.615	86.727	472.130	86.768	474.647	86.813	477.165	86.859	479.683	86.908	482.202	86.958	484.722	87.012	487.243	87.067	489.764	87.123	492.287	87.185	494.810	87.247	1000	
900	422.150	78.046	424.666	78.087	427.183	78.131	429.700	78.178	432.219	78.227	434.738	78.278	437.258	78.333	439.779	78.389	442.301	78.448	444.824	78.510	447.348	78.574	449.872	78.640	452.398	78.709	900	
800	379.718	69.450	382.235	69.497	384.754	69.546	387.274	69.599	389.794	69.654	392.316	69.712	394.839	69.772	397.362	69.836	399.887	69.903	402.412	69.972	404.939	70.044	407.466	70.119	409.995	70.197	800	
700	337.289	60.866	339.810	60.919	342.331	60.976	344.853	61.035	347.376	61.099	349.901	61.165	352.427	61.234	354.953	61.307	357.481	61.383	360.010	61.462	362.541	61.544	365.072	61.630	367.604	61.719	700	
600	294.867	51.299	297.391	52.361	299.915	52.427	302.441	52.497	304.968	52.570	307.496	52.647	310.026	52.729	312.557	52.813	315.089	52.902	317.623	52.994	320.157	53.090	322.693	53.190	325.230	53.294	600	
500	252.455	43.739	254.982	43.834	257.511	43.913	260.042	43.997	262.574	44.085	265.108	44.178	267.643	44.275	270.179	44.377	272.718	44.483	275.257	44.594	277.798	44.709	280.341	44.829	282.884	44.953	500	
400	210.059	35.268	212.593	35.361	215.129	35.460	217.666	35.565	220.206	35.675	222.747	35.791	225.290	35.912	227.835	36.040	230.381	36.172	232.929	36.311	235.479	36.455	238.031	36.604	240.584	36.760	400	
360	193.109	31.894	193.646	31.998	198.185	32.107	200.726	32.224	203.270	32.346	205.815	32.475	208.362	32.610	210.911	32.751	213.462	32.898	216.015	33.052	218.570	33.212	221.126	33.378	223.684	33.551	360	100 (P)*
350	188.872	31.053	191.410	31.160	193.950	31.273	196.493	31.392	199.037	31.518	201.583	31.651	204.132	31.790	206.682	31.935	209.234	32.086	211.788	32.244	213.344	32.409	216.902	32.580	219.462	32.757	350	
300	167.696	26.873	170.240	26.997	172.786	27.129	175.334	27.269	177.885	27.415	180.438	27.570	182.993	27.731	185.551	27.901	188.110	28.078	190.672	28.262	193.235	28.454	195.801	28.653	198.369	28.860	300	
250	146.537	22.748	149.088	22.897	151.642	23.055	154.199	23.222	156.758	23.398	159.320	23.583	161.885	23.777	164.451	23.980	167.020	24.192	169.592	24.413	172.165	24.643	174.741	24.881	177.319	25.129	250	
230	138.080	21.121	140.636	21.283	143.194	21.455	145.755	21.636	148.316	21.828	150.844	22.029	153.453	22.239	156.024	22.460	158.598	22.690	161.174	22.930	163.752	23.179	166.333	23.439	168.916	23.707	230	80 (P)*
200	123.407	18.718	127.869	18.903	130.334	19.102	133.102	19.310	135.673	19.530	138.247	19.761	140.824	20.003	143.403	20.256	145.985	20.521	148.569	20.796	151.156	21.082	153.745	21.380	156.336	21.689	200	
170	112.751	16.382	115.322	16.601	117.896	16.833	120.474	17.078	123.054	17.336	125.637	17.607	128.223	17.891	130.812	18.188	133.404	18.498	135.998	18.822	138.594	19.158	141.193	19.507	143.794	19.868	170	
155	106.433	15.250	109.009	15.490	111.589	15.744	114.172	16.013	116.757	16.295	119.346	16.592	121.938	16.904	124.532	17.229	127.129	17.569	129.729	17.922	132.331	18.290	134.935	18.672	137.541	19.068	155	65 (P)*
125	93.825	13.104	96.414	13.401	99.006	13.715	101.602	14.046	104.201	14.396	106.802	14.762	109.407	15.146	112.013	15.548	114.622	15.967	117.233	16.403	119.846	16.856	122.460	17.326	125.076	17.814	125	
100	83.361	11.516	85.962	11.885	88.568	12.276	91.176	12.688	93.787	13.122	96.400	13.578	99.015	14.054	101.631	14.552	104.249	15.071	106.868	15.611	109.487	16.171	112.107	16.753	114.726	17.354	100	
90	79.190	10.969	81.797	11.377	84.408	11.810	87.021	12.267	89.636	12.747	92.253	13.250	94.871	13.777	97.491	14.328	100.110	14.901	102.730	15.497	105.349	16.116	107.967	16.757	110.584	17.420	90	30 (P)
80	75.029	10.498	77.643	10.956	80.258	11.440	82.876	11.951	85.494	12.489	88.114	13.052	90.733	13.641	93.352	14.255	95.971	14.895	98.588	15.559	101.203	16.249	103.816	16.962	106.426	17.700	80	30 (H)**
70	70.880	10.136	73.498	10.656	76.117	11.206	78.737	11.786	81.356	12.395	83.974	13.033	86.591	13.699	89.206	14.394	91.818	15.116	94.426	15.866	97.030	16.643	99.629	17.447	102.223	18.276	70	
60	66.740	9.934	69.359	10.536	71.978	11.171	74.595	11.840	77.209	12.541	79.810	13.275	82.425	14.041	85.025	14.838	87.619	15.665	90.206	16.523	92.785	17.410	95.355	18.321	97.915	19.270	60	40 (P)*
55	64.671	9.919	67.289	10.571	69.904	11.259	72.515	11.983	75.122	12.741	77.723	13.534	80.318	14.360	82.904	15.219	85.482	16.110	88.049	17.032	90.606	17.985	93.151	18.967	95.682	19.979	55	
50	62.598	9.981	65.211	10.699	67.819	11.442	70.422	12.230	73.016	13.054	75.602	13.915	78.178	14.811	80.743	15.741	83.296	16.704	85.835	17.700	88.359	18.727	90.867	19.784	93.359	20.870	50	40 (H)**
45	60.516	10.145	63.119	10.927	65.715	11.749	68.300	12.612	70.874	13.513	73.436	14.452	75.983	15.428	78.515	16.440	81.030	17.483	83.526	18.554	86.002	19.674	88.458	20.814	90.895	21.983	45	25 (P)*
40	58.413	10.444	60.998	11.309	63.570	12.217	66.127	13.168	68.668	14.160	71.190	15.190	73.692	16.259	76.172	17.363	78.629	18.501	81.060	19.672							40	30 (H)**
35	56.264	10.924	58.816	11.890	61.348	12.901	63.857	13.956	66.342	15.053	68.800	16.188															35	25 (H)**
33	55.382	11.182	57.914	12.193	60.422	13.251	62.904	14.352	65.357	15.493																	33	30 (P)*
30	54.020	11.657	56.511	12.743	58.972	13.876																					30	30 (H)**
25																											25	25 (H)**
23																											23	20 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 47 Degrees

$\Delta = 47°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s				
metre																									metre			
2500	1094 531	226 109	1097 033	226 109	1099 534	226 113	1102 036	226 118	1104 539	226 124	1107 042	226 131	1109 544	226 139	1112 048	226 147	1114 552	226 157	1117 056	226 167	1119 560	226 178	1122 065	226 191	1124 570	226 204	2500	
2200	964 088	198 974	966 590	198 978	969 091	198 982	971 594	198 988	974 096	198 995	976 599	199 003	979 103	199 011	981 607	199 021	984 111	199 032	986 616	199 044	989 121	199 057	991 626	199 071	994 132	199 086	2200	
2000	877 126	180 886	879 627	180 891	882 130	180 896	884 632	180 902	887 135	180 909	889 638	180 918	892 142	180 927	894 646	180 938	897 151	180 950	899 656	180 963	902 162	180 978	904 668	180 993	907 174	181 009	2000	
1800	790 164	162 799	792 666	162 803	795 168	162 809	797 671	162 816	800 174	162 824	802 678	162 834	805 182	162 844	807 687	162 856	810 192	162 870	812 698	162 884	815 204	162 900	817 710	162 917	820 218	162 935	1800	
1500	659 721	135 668	662 223	135 673	664 725	135 680	667 229	135 688	669 733	135 698	672 237	135 709	674 742	135 722	677 248	135 737	679 754	135 753	682 261	135 770	684 769	135 789	687 276	135 810	689 785	135 832	1500	
1200	529 278	108 537	531 780	108 544	534 284	108 552	536 788	108 563	539 293	108 575	541 798	108 590	544 305	108 605	546 812	108 624	549 320	108 643	551 828	108 665	554 337	108 689	556 847	108 714	559 358	108 742	1200	
1000	442 316	90 451	444 819	90 459	447 323	90 469	449 828	90 482	452 334	90 496	454 841	90 513	457 348	90 533	459 857	90 554	462 366	90 578	464 876	90 604	467 387	90 633	469 899	90 663	472 412	90 696	1000	
900	398 835	81 408	401 339	81 417	403 844	81 428	406 349	81 442	408 855	81 458	411 363	81 477	413 871	81 499	416 380	81 523	418 891	81 550	421 402	81 579	423 914	81 610	426 428	81 644	428 942	81 681	900	
800	355 355	72 365	357 859	72 375	360 364	72 388	362 870	72 404	365 377	72 422	367 885	72 443	370 395	72 468	372 906	72 494	375 417	72 524	377 930	72 555	380 444	72 593	382 958	72 631	385 474	72 672	800	
700	311 874	63 323	314 379	63 335	316 884	63 349	319 391	63 367	321 900	63 388	324 409	63 412	326 920	63 440	329 432	63 471	331 945	63 505	334 460	63 542	336 975	63 583	339 492	63 627	342 010	63 674	700	100 (P)*
600	268 394	54 281	270 899	54 295	273 406	54 312	275 914	54 333	278 424	54 357	280 935	54 385	283 447	54 418	285 961	54 454	288 477	54 493	290 993	54 537	293 511	54 584	296 031	54 635	298 552	54 690	600	
500	224 914	45 241	227 420	45 257	229 928	45 277	232 438	45 302	234 950	45 332	237 463	45 366	239 978	45 404	242 494	45 448	245 013	45 495	247 533	45 548	250 054	45 604	252 578	45 666	255 103	45 731	500	
400	181 435	36 302	183 943	36 322	186 453	36 347	188 965	36 379	191 479	36 418	193 996	36 463	196 514	36 516	199 035	36 580	201 557	36 650	204 082	36 585	206 609	36 656	209 138	36 733	211 668	36 815	400	
360	164 044	32 587	166 552	32 609	169 063	32 637	171 577	32 672	174 093	32 713	176 611	32 760	179 131	32 814	181 654	32 874	184 179	32 940	186 706	33 013	189 236	33 092	191 768	33 177	194 302	33 268	360	
350	159 696	31 684	162 205	31 706	164 716	31 735	167 230	31 771	169 746	31 813	172 265	31 862	174 786	31 917	177 309	31 979	179 835	32 047	182 363	32 122	184 894	32 203	187 426	32 290	189 961	32 384	350	
300	137 957	27 166	140 467	27 193	142 981	27 227	145 497	27 269	148 016	27 318	150 537	27 375	153 062	27 439	155 589	27 511	158 118	27 590	160 651	27 677	163 186	27 772	165 723	27 874	168 264	27 984	300	80 (P)*
250	116 219	22 651	118 731	22 683	121 247	22 724	123 766	22 774	126 289	22 833	128 815	22 901	131 344	22 978	133 876	23 064	136 411	23 160	138 949	23 264	141 491	23 378	144 035	23 500	146 582	23 632	250	
230	107 528	20 846	110 038	20 880	112 555	20 925	115 076	20 979	117 600	21 043	120 128	21 117	122 659	21 201	125 194	21 295	127 732	21 399	130 273	21 512	132 818	21 635	135 365	21 769	137 916	21 911	230	
200	94 482	18 139	96 998	18 179	99 517	18 230	102 041	18 293	104 569	18 366	107 101	18 452	109 636	18 548	112 176	18 656	114 719	18 775	117 266	18 905	119 816	19 047	122 370	19 200	124 927	19 364	200	65 (P)*
170	81 442	15 435	83 959	15 482	86 482	15 542	89 010	15 615	91 542	15 702	94 079	15 802	96 621	15 916	99 166	16 043	101 716	16 183	104 270	16 336	106 828	16 503	109 390	16 683	111 956	16 876	170	
155	74 922	14 084	77 441	14 136	79 966	14 201	82 496	14 282	85 032	14 377	87 572	14 487	90 117	14 611	92 666	14 750	95 220	14 904	97 779	15 072	100 341	15 255	102 908	15 452	105 479	15 664	155	
125	61 883	11 387	64 407	11 450	66 938	11 532	69 475	11 632	72 017	11 750	74 566	11 886	77 120	12 040	79 680	12 212	82 245	12 403	84 815	12 611	87 389	12 837	89 968	13 081	92 552	13 343	125	
100	51 021	9 146	53 550	9 226	56 088	9 328	58 633	9 453	61 185	9 600	63 744	9 770	66 309	9 962	68 881	10 177	71 459	10 415	74 042	10 674	76 630	10 956	79 223	11 261	81 820	11 587	100	
90	46 677	8 253	49 209	8 342	51 751	8 455	54 300	8 594	56 857	8 757	59 422	8 946	61 993	9 160	64 571	9 398	67 155	9 662	69 744	9 950	72 339	10 263	74 938	10 600	77 542	10 962	90	50 (P)*
80	42 334	7 363	44 870	7 462	47 416	7 590	49 971	7 746	52 534	7 930	55 105	8 142	57 681	8 382	60 268	8 650	62 859	8 946	65 456	9 270	68 058	9 621	70 665	9 999	73 276	10 405	80	50 (H)**
70	37 992	6 477	40 533	6 590	43 085	6 736	45 646	6 914	48 217	7 124	50 795	7 366	53 382	7 640	55 975	7 946	58 575	8 284	61 180	8 652	63 790	9 052	66 404	9 483	69 022	9 945	70	
60	33 651	5 593	36 200	5 729	38 759	5 899	41 329	6 106	43 908	6 351	46 496	6 633	49 092	6 952	51 695	7 308	54 304	7 700	56 918	8 129	59 536	8 593	62 157	9 092	64 781	9 627	60	40 (P)*
55	31 484	5 160	34 035	5 304	36 599	5 490	39 173	5 716	41 758	5 983	44 351	6 290	46 953	6 637	49 561	7 023	52 175	7 451	54 793	7 917	57 415	8 421	60 038	8 964	62 663	9 545	55	
50	29 316	4 726	31 872	4 885	34 441	5 089	37 021	5 337	39 611	5 630	42 211	5 968	44 818	6 349	47 432	6 774	50 050	7 241	52 672	7 752	55 296	8 304	57 921	8 898	60 546	9 532	50	40 (H)**
45	27 150	4 297	29 711	4 473	32 285	4 699	34 872	4 975	37 469	5 300	40 075	5 674	42 688	6 099	45 307	6 566	47 929	7 084	50 554	7 647	53 179	8 257	55 803	8 912	58 424	9 610	45	35 (P)*
40	24 985	3 873	27 552	4 071	30 134	4 325	32 728	4 635	35 332	5 000	37 945	5 419	40 564	5 892	43 087	6 418	45 812	6 996	48 417	7 626	51 059	8 305	53 678	9 034	56 290	9 810	40	35 (H) 30 (P)*
35	22 823	3 457	25 398	3 683	27 988	3 973	30 590	4 326	33 202	4 742	35 821	5 218	38 445	5 756	41 070	6 352	43 694	7 007	46 314	7 718	48 927	8 484	51 531	9 304	54 124	10 175	35	
33	21 959	3 294	24 537	3 531	27 131	3 841	29 737	4 215	32 352	4 654	34 973	5 159	37 598	5 727	40 223	6 357	42 845	7 048	45 460	7 797	48 067	8 604	50 661	9 466	53 241	10 382	33	
30	20 664	3 053	23 248	3 317	25 847	3 654	28 459	4 064	31 079	4 546	33 703	5 098	36 328	5 710	38 950	6 407	41 565	7 190	44 170	7 975	46 761	8 850	49 334	9 784	51 887	10 772	30	30 (H)**
25	18 510	2 669	21 105	2 984	23 716	3 387	26 336	3 876	28 961	4 439	31 584	5 101	34 202	5 837	36 806	6 646	39 406	7 527	41 963	8 477	44 506	9 492	47 017	10 568	49 491	11 700	25	
23	17 651	2 523	20 251	2 865	22 866	3 302	25 489	3 831	28 114	4 451	30 734	5 167	33 341	5 986	35 926	6 915	38 486	7 961	41 043	8 995	43 554	9 956	46 022	10 997			23	25 (P)*
20	16 364	2 317	18 973	2 709	21 594	3 209	24 218	3 811	26 839	4 517	29 446	5 317	32 033	6 207	34 592	7 192	37 124	8 235	39 595	9 301							20	25 (H)**
15	14 229	2 032	16 851	2 540	19 475	3 203	22 085	3 987	24 667	4 892	27 208	5 907	29 691	7 024													15	20 (P)*
14	13 804	1 989	16 428	2 541	19 049	3 238	21 649	4 070	24 214	4 927	26 727	6 096															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 47 Degrees

Δ=47°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h.
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	1127.076	226.218	1129.582	226.233	1132.088	226.249	1134.595	226.266	1137.102	226.284	1139.609	226.302	1142.117	226.322	1144.625	226.342	1147.133	226.364	1149.642	226.386	1152.151	226.409	1154.660	226.433	1157.170	226.458	2500	
2200	996.638	199.102	999.145	199.119	1001.652	199.137	1004.160	199.156	1006.668	199.176	1009.176	199.197	1011.685	199.220	1014.194	199.243	1016.703	199.269	1019.213	199.292	1021.723	199.319	1024.234	199.346	1026.745	199.374	2200	
2000	909.681	181.027	912.189	181.046	914.697	181.065	917.205	181.086	919.713	181.109	922.223	181.132	924.732	181.156	927.242	181.182	929.753	181.209	932.263	181.236	934.775	181.265	937.287	181.295	939.798	181.327	2000	
1800	822.725	162.955	825.233	162.976	827.742	162.998	830.251	163.021	832.761	163.046	835.271	163.072	837.781	163.099	840.293	163.127	842.804	163.157	845.316	163.188	847.829	163.220	850.342	163.253	852.855	163.288	1800	
1500	692.294	135.855	694.804	135.880	697.315	135.906	699.825	135.935	702.337	135.964	704.849	135.995	707.362	136.028	709.875	136.062	712.389	136.097	714.903	136.135	717.418	136.173	719.933	136.213	722.449	146.255	1500	
1200	561.869	108.771	564.382	108.802	566.895	108.836	569.408	108.870	571.922	108.907	574.437	108.946	576.953	108.987	579.470	109.030	581.987	109.074	584.505	109.120	587.023	109.169	589.542	109.219	592.063	109.271	1200	
1000	474.926	90.731	477.440	90.769	479.956	90.809	482.472	90.851	484.989	90.895	487.507	90.941	490.026	90.990	492.545	91.042	495.066	91.095	497.587	91.150	500.109	91.208	502.632	91.269	505.156	91.331	1000	
900	431.457	81.720	433.973	81.761	436.490	81.806	439.008	81.852	441.527	81.901	444.047	81.953	446.567	82.007	449.089	82.064	451.612	82.124	454.135	82.185	456.660	82.250	459.185	82.316	461.711	82.386	900	
800	387.991	72.716	390.509	72.763	393.028	72.813	395.548	72.865	398.069	72.920	400.592	72.979	403.115	73.040	405.639	73.104	408.164	73.170	410.691	73.240	413.218	73.312	415.746	73.387	418.275	73.465	800	
700	344.530	63.724	347.050	63.777	349.572	63.834	352.094	63.894	354.619	63.958	357.144	64.024	359.670	64.094	362.198	64.167	364.726	64.243	367.256	64.322	369.787	64.405	372.319	64.491	374.852	64.580	700	
600	301.074	54.749	303.598	54.812	306.123	54.878	308.650	54.948	311.177	55.021	313.707	55.099	316.237	55.180	318.769	55.266	321.302	55.355	323.836	55.447	326.372	55.544	328.909	55.644	331.447	55.748	600	
500	257.629	45.802	260.157	45.877	262.687	45.956	265.219	46.040	267.751	46.129	270.286	46.222	272.822	46.319	275.360	46.422	277.899	46.528	280.439	46.639	282.981	46.755	285.525	46.875	288.070	47.000	500	
400	214.201	36.903	216.736	36.997	219.272	37.096	221.811	37.201	224.351	37.312	226.894	37.428	229.438	37.550	231.984	37.677	234.531	37.811	237.081	37.950	239.632	38.094	242.185	38.244	244.740	38.400	400	
360	196.838	33.366	199.376	33.470	201.916	33.580	204.459	33.697	207.003	33.820	209.550	33.949	212.098	34.085	214.648	34.226	217.201	34.374	219.755	34.528	222.311	34.689	224.869	34.856	227.429	35.029	360	100 (P)*
350	192.498	32.485	195.037	32.592	197.578	32.705	200.122	32.825	202.667	32.952	205.215	33.084	207.763	33.224	210.316	33.370	212.870	33.521	215.426	33.680	217.983	33.845	220.543	34.017	223.104	34.195	350	
300	170.806	28.101	173.351	28.226	175.899	28.358	178.448	28.498	181.001	28.645	183.555	28.800	186.112	28.962	188.671	29.133	191.232	29.310	193.795	29.495	196.361	29.688	198.928	29.887	201.498	30.095	300	
250	149.132	23.772	151.685	23.922	154.241	24.081	156.799	24.248	159.360	24.425	161.924	24.611	164.490	24.805	167.058	25.009	169.629	25.222	172.203	25.444	174.779	25.674	177.357	25.914	179.937	26.162	250	
230	140.470	22.064	143.027	22.227	145.587	22.399	148.149	22.581	150.714	22.773	153.283	22.975	155.853	23.187	158.427	23.408	161.002	23.639	163.581	23.880	166.161	24.130	168.745	24.391	171.330	24.660	230	80 (P)*
200	127.488	19.540	130.052	19.727	132.619	19.925	135.189	20.134	137.762	20.355	140.338	20.587	142.917	20.830	145.499	21.084	148.083	21.349	150.670	21.625	153.259	21.913	156.851	22.212	158.445	22.521	200	
170	114.525	17.082	117.098	17.302	119.674	17.534	122.254	17.780	124.837	18.039	127.423	18.312	130.011	18.597	132.603	18.895	135.198	19.206	137.795	19.531	140.394	19.868	142.996	20.219	145.600	20.582	170	
155	108.053	15.890	110.632	16.130	113.214	16.386	115.799	16.655	118.387	16.939	120.979	17.237	123.574	17.549	126.171	17.876	128.772	18.217	131.374	18.572	133.980	18.941	136.587	19.325	139.197	19.722	155	65 (P)*
125	95.140	13.623	97.731	13.920	100.326	14.236	102.925	14.569	105.527	14.919	108.132	15.287	110.740	15.673	113.351	16.076	115.964	16.496	118.579	16.934	121.196	17.389	123.815	17.861	126.435	18.350	125	
100	84.422	11.935	87.027	12.306	89.636	12.698	92.248	13.112	94.863	13.547	97.480	14.004	100.100	14.483	102.721	14.982	105.344	15.503	107.968	16.045	110.592	16.608	113.218	17.191	115.843	17.795	100	
90	80.150	11.348	82.762	11.758	85.377	12.193	87.994	12.651	90.614	13.133	93.236	13.638	95.859	14.167	98.483	14.720	101.108	15.295	103.733	15.893	106.358	16.514	108.983	17.158	111.606	17.823	90	50 (P)
80	75.890	10.838	78.508	11.298	81.128	11.784	83.751	12.297	86.374	12.836	88.999	13.401	91.624	13.992	94.249	14.609	96.874	15.251	99.497	15.918	102.119	16.610	104.738	17.327	107.355	18.067	80	50 (H)**
70	71.643	10.457	74.265	10.959	76.890	11.511	79.515	12.093	82.140	12.705	84.764	13.345	87.388	14.014	90.009	14.711	92.628	15.436	95.243	16.189	97.855	16.968	100.461	17.775	103.063	18.608	70	
60	67.406	10.197	70.031	10.801	72.655	11.438	75.278	12.110	77.899	12.814	80.516	13.591	83.130	14.319	85.738	15.119	88.339	15.950	90.934	16.810	93.522	17.701	96.100	18.620	98.669	19.568	60	40 (P) *
55	65.288	10.162	67.912	10.817	70.534	11.508	73.153	12.234	75.767	12.996	78.376	13.791	80.978	14.620	83.572	15.483	86.158	16.377	88.735	17.303	91.300	18.259	93.855	14.245	96.396	20.260	55	
50	63.169	10.207	65.789	10.921	68.404	11.673	71.014	12.464	73.616	13.291	76.210	14.155	78.795	15.054	81.369	15.988	83.931	16.955	86.479	17.954	89.013	18.985	91.531	20.046	94.033	21.136	50	40 (H)**
45	61.041	10.352	63.652	11.137	66.255	11.962	68.848	12.828	71.431	13.733	74.002	14.676	76.558	15.655	79.100	16.670	81.624	17.720	84.131	18.802	86.618	19.916	89.084	21.061	91.528	22.234	45	35 (P)*
40	58.893	10.633	61.486	11.501	64.067	12.413	66.633	13.368	69.183	14.363	71.715	15.398	74.228	16.470	76.718	17.578	79.186	18.721	81.628	19.896							40	30 (H)**
35	56.701	11.097	59.262	12.066	61.803	13.081	64.323	14.140	66.818	15.241	69.287	16.381															35	
33	55.803	11.348	58.344	12.363	60.862	13.425	63.355	14.530	65.819	15.677																	33	30 (P)*
30	54.416	11.813	56.918	12.904	59.389	14.041																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 48 Degrees

$\Delta = 48°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1120.573	236.594	1123.074	236.597	1125.575	236.601	1128.077	236.606	1130.580	236.612	1133.083	236.619	1135.586	236.627	1138.089	236.635	1140.593	236.645	1143.097	236.656	1145.602	236.667	1148.107	236.679	1150.612	236.693	2500	
2200	987.004	208.204	989.505	208.208	992.006	208.212	994.510	208.218	997.013	208.225	999.516	208.232	1002.020	208.241	1004.523	208.451	1007.028	208.262	1009.532	208.274	1012.038	208.287	1014.543	208.301	1017.050	208.316	2200	
2000	897.959	189.277	900.460	189.281	902.962	189.286	905.465	189.292	907.969	189.300	910.472	189.309	912.976	189.318	915.480	189.329	917.984	189.341	920.490	189.354	922.996	189.368	925.502	189.384	928.008	189.400	2000	
1800	808.913	170.350	811.415	170.355	813.917	170.361	816.420	170.367	818.924	170.376	821.427	170.385	823.932	170.396	826.437	170.408	828.942	170.421	831.448	170.436	833.954	170.452	836.461	170.469	838.969	170.487	1800	
1500	675.345	141.961	677.847	141.966	680.350	141.973	682.854	141.981	685.358	141.991	687.862	142.003	690.367	142.015	692.873	142.030	695.380	142.046	697.886	142.063	700.394	142.083	702.902	142.103	705.411	142.125	1500	
1200	541.778	113.572	544.280	113.578	546.784	113.587	549.288	113.597	551.793	113.610	554.299	113.624	556.805	113.640	559.312	113.658	561.820	113.678	564.328	113.700	566.839	113.724	569.349	113.750	571.860	113.777	1200	
1000	452.732	94.646	455.236	94.654	457.740	94.665	460.245	94.677	462.751	94.692	465.258	94.709	467.765	94.729	470.274	94.750	472.784	94.774	475.294	94.800	477.805	94.829	480.318	94.859	482.831	94.893	1000	
900	408.210	85.184	410.714	85.193	413.219	85.204	415.724	85.218	418.230	85.234	420.738	85.253	423.247	85.275	425.756	85.299	428.267	85.326	430.779	85.355	433.291	85.386	435.805	85.421	438.319	85.458	900	
800	363.688	75.722	366.192	75.731	368.697	75.744	371.203	75.760	373.711	75.779	376.219	75.800	378.729	75.824	381.240	75.851	383.752	75.881	386.265	75.914	388.779	75.949	391.294	75.988	393.810	76.030	800	
700	319.166	66.260	321.670	66.271	324.176	66.284	326.683	66.304	329.192	66.325	331.702	66.349	334.213	66.377	336.725	66.408	339.239	66.442	341.754	66.480	344.269	66.521	346.787	66.564	349.305	66.612	700	100 (P)*
600	274.644	56.799	277.149	56.812	279.656	56.829	282.165	56.850	284.674	56.875	287.186	56.903	289.699	56.936	292.213	56.972	294.729	57.011	297.246	57.055	299.764	57.103	302.285	57.154	304.806	57.209	600	
500	230.122	47.339	232.629	47.354	235.137	47.373	237.647	47.400	240.159	47.430	242.672	47.464	245.188	47.503	247.705	47.546	250.224	47.594	252.744	47.646	255.266	47.703	257.790	47.765	260.316	47.831	500	
400	185.602	37.880	188.110	37.900	190.620	37.926	193.132	37.957	195.647	37.994	198.164	38.037	200.683	38.085	203.204	38.140	205.727	38.199	208.253	38.265	210.780	38.336	213.310	38.413	215.841	38.496	400	
360	167.794	34.098	170.303	34.120	172.814	34.148	175.328	34.183	177.844	34.224	180.363	34.271	182.884	34.325	185.407	34.386	187.933	34.452	190.461	34.525	192.991	34.604	195.524	34.689	198.058	34.781	360	
320	149.342	33.132	151.851	33.175	154.361	33.224	156.873	33.280	159.387	33.344	161.903	33.416	164.421	33.496	166.941	33.584	169.463	33.680	171.987	33.784	174.513	33.897	177.041	34.018	179.571	34.148	320	
300	141.082	28.425	143.593	28.452	146.106	28.486	148.623	28.528	151.142	28.577	153.664	28.634	156.189	28.699	158.717	28.771	161.248	28.850	163.781	28.938	166.317	29.033	168.855	29.135	171.397	29.245	300	80 (P)*
250	118.824	23.700	121.336	23.732	123.852	23.773	126.372	23.822	128.893	23.882	131.422	23.951	133.951	24.028	136.484	24.115	139.020	24.211	141.560	24.315	144.102	24.429	146.648	24.552	149.196	24.684	250	
230	109.920	21.810	112.434	21.846	114.952	21.890	117.473	21.945	119.998	22.009	122.527	22.083	125.059	22.168	127.594	22.262	130.133	22.366	132.676	22.480	135.221	22.604	137.770	22.737	140.323	22.881	230	
200	96.566	18.979	99.082	19.018	101.602	19.070	104.126	19.132	106.655	19.206	109.187	19.292	111.724	19.389	114.264	19.497	116.809	19.617	119.357	19.748	121.909	19.890	124.464	20.043	127.022	20.208	200	
170	83.213	16.148	85.731	16.193	88.253	16.256	90.783	16.329	93.316	16.417	95.854	16.517	98.397	16.631	100.943	16.758	103.495	16.899	106.050	17.053	108.610	17.220	111.173	17.401	113.741	17.595	170	65 (P)*
155	76.337	14.735	79.057	14.786	81.382	14.852	84.113	14.933	86.650	15.029	89.191	15.139	91.737	15.264	94.288	15.404	96.843	15.558	99.403	15.726	101.968	15.910	104.536	16.108	107.109	16.320	155	
125	63.186	11.912	65.711	11.975	68.242	12.057	70.780	12.158	73.324	12.276	75.874	12.413	78.429	12.568	80.991	12.740	83.557	12.931	86.129	13.140	88.706	13.367	91.287	13.612	93.873	13.875	125	
100	51.063	9.565	54.594	9.646	57.132	9.748	59.678	9.874	62.232	10.022	64.793	10.193	67.360	10.386	69.934	10.601	72.513	10.840	75.099	11.100	77.690	11.383	80.285	11.689	82.886	12.016	100	
90	47.615	8.631	50.149	8.720	52.691	8.834	55.242	8.973	57.801	9.137	60.367	9.327	62.940	9.541	65.520	9.781	68.107	10.045	70.699	10.334	73.297	10.648	73.899	10.987	78.507	11.350	90	50 (P)*
80	43.168	7.699	45.706	7.799	48.253	7.927	50.809	8.083	53.374	8.268	55.947	8.481	58.527	8.722	61.115	8.991	63.709	9.288	66.309	9.613	68.914	9.965	71.525	10.345	74.139	10.753	80	50 (H)**
70	38.723	6.771	41.265	6.885	43.818	7.031	46.381	7.210	48.954	7.421	51.534	7.664	54.123	7.939	56.720	8.246	59.322	8.585	61.931	8.955	64.545	9.356	67.163	9.789	69.786	10.252	70	
60	34.279	5.849	36.828	5.982	39.389	6.153	41.960	6.361	44.542	6.607	47.133	6.890	49.732	7.210	52.338	7.567	54.951	7.960	57.569	8.390	60.191	8.856	62.817	9.358	65.446	9.895	60	40 (P)*
55	32.059	5.391	34.611	5.536	37.176	5.722	39.753	5.949	42.340	6.217	44.937	6.526	47.542	6.874	50.153	7.263	52.771	7.691	55.394	8.159	58.020	8.665	60.649	9.210	63.280	9.793	55	
50	29.839	4.933	32.396	5.096	34.967	5.301	37.549	5.550	40.143	5.844	42.745	6.183	45.356	6.566	47.974	6.992	50.597	7.462	53.224	7.974	55.853	8.528	58.484	9.124	61.115	9.761	50	40 (H)**
45	27.621	4.486	30.183	4.663	32.760	4.890	35.349	5.167	37.950	5.494	40.559	5.869	43.176	6.293	45.800	6.765	48.427	7.284	51.057	7.850	53.688	8.462	56.318	9.119	58.946	9.821	45	35 (P)*
40	25.405	4.042	27.973	4.241	30.557	4.496	33.154	4.807	35.762	5.173	38.379	5.594	41.003	6.069	43.631	6.597	46.261	7.177	48.892	7.809	51.521	8.491	54.146	9.222	56.765	10.003	40	35 (H) 30 (P)*
35	23.191	3.605	25.767	3.832	28.360	4.123	30.966	4.477	33.582	4.894	36.205	5.373	38.834	5.913	41.465	6.511	44.095	7.168	46.722	7.882	49.343	8.652	51.955	9.474	54.555	10.349	35	
33	22.305	3.433	24.886	3.674	27.483	3.982	30.092	4.358	32.712	4.799	35.338	5.306	37.968	5.876	40.599	6.508	43.227	7.202	45.850	7.954	48.464	8.764	51.067	9.630	53.655	10.549	33	
30	20.980	3.180	23.566	3.445	26.169	3.783	28.784	4.195	31.409	4.679	34.038	5.233	36.669	5.857	39.297	6.547	41.920	7.302	44.532	8.121	47.132	9.000	49.714	9.937	52.277	10.929	30	30 (H)**
25	18.775	2.773	21.373	3.092	23.987	3.496	26.612	3.987	29.247	4.567	31.892	5.219	34.547	5.953	37.210	6.767	39.880	7.652	42.555	8.606	45.236	9.625	47.926	10.705	50.624	11.847	25	
23	17.895	2.621	20.498	2.965	23.117	3.403	25.745	3.934	28.376	4.556	31.003	5.265	33.630	6.058	36.221	6.930	38.800	7.878	41.351	8.897	43.868	9.982	46.347	11.128			23	25 (P)*
20	16.577	2.403	19.190	2.797	21.815	3.298	24.446	3.904	27.073	4.611	29.688	5.414	32.284	6.307	34.851	7.286	37.383	8.344	39.873	9.473							20	25 (H)**
15	14.392	2.098	17.019	2.617	19.649	3.273	22.266	4.060	24.857	4.968	27.408	5.987	29.905	7.105													15	20 (P)*
14	13.957	2.050	16.586	2.605	19.213	3.304	21.822	4.140	24.396	5.100	26.919	6.174															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 48 Degrees

$\Delta = 48°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1153.118	236.707	1155.624	236.722	1158.130	236.738	1160.637	236.755	1163.144	236.772	1165.652	236.791	1168.160	236.811	1170.668	236.831	1173.177	236.853	1175.686	236.875	1178.195	236.898	1180.704	236.922	1183.215	236.948	2500	
2200	1019.556	208.332	1022.063	208.349	1024.570	208.367	1027.078	208.386	1029.586	208.406	1032.094	208.428	1034.603	208.450	1037.113	208.473	1039.622	208.498	1042.132	208.523	1044.643	208.550	1047.154	208.577	1049.665	208.605	2200	
2000	930.516	186.418	933.023	189.437	935.531	189.457	938.039	189.478	940.548	189.500	943.058	189.523	945.567	189.548	948.078	189.573	950.589	189.600	953.100	189.628	955.611	189.657	958.123	189.688	960.635	189.719	2000	
1800	841.426	170.507	843.985	170.528	846.493	170.550	849.003	170.573	851.513	170.598	854.023	170.624	856.534	170.651	859.045	170.680	861.557	170.709	864.070	170.740	866.582	170.773	869.096	170.807	871.610	170.841	1800	
1500	707.921	142.148	710.431	142.174	712.941	142.200	715.453	142.229	717.964	142.258	720.477	142.289	722.990	142.322	725.503	142.356	728.017	142.392	730.532	142.429	733.047	142.468	735.563	142.508	738.080	142.550	1500	
1200	574.371	113.806	576.884	113.838	579.397	113.871	581.911	113.906	584.426	113.943	586.941	113.982	589.457	114.023	591.974	114.066	594.492	114.111	597.010	114.157	599.529	114.205	602.049	114.256	604.569	114.308	1200	
1000	485.345	94.928	487.860	94.966	490.376	95.005	492.892	95.048	495.410	95.092	497.928	95.139	500.447	95.188	502.967	95.239	505.488	95.292	508.010	95.348	510.533	95.407	513.056	95.467	515.580	95.530	1000	
900	440.835	85.497	443.351	85.539	445.869	85.583	448.387	85.630	450.906	85.679	453.427	85.731	455.945	85.783	458.470	85.842	460.993	85.902	463.518	85.964	466.042	86.029	468.568	86.096	471.095	86.166	900	
800	396.318	76.073	398.846	76.121	401.366	76.171	403.886	76.223	406.408	76.279	408.931	76.337	411.455	76.398	413.979	76.463	416.505	76.530	419.032	76.600	421.560	76.672	424.089	76.748	426.619	76.826	800	
700	351.825	66.662	354.346	66.716	356.868	66.773	359.392	66.833	361.916	66.897	364.442	66.963	366.969	67.033	369.497	67.107	372.027	67.183	374.557	67.263	377.089	67.346	379.622	67.432	382.156	67.522	700	
600	307.329	57.268	309.853	57.331	312.379	57.397	314.906	57.468	317.435	57.542	319.964	57.619	322.496	57.701	325.028	57.787	327.562	57.876	330.097	57.969	332.634	58.066	335.172	58.167	337.711	58.271	600	
500	262.843	47.902	265.372	47.977	267.903	48.057	270.435	48.141	272.969	48.230	275.504	48.323	278.041	48.421	280.579	48.524	283.119	48.631	285.661	48.742	288.204	48.859	290.749	48.979	293.295	49.104	500	
400	218.375	38.584	220.910	38.678	223.448	38.777	225.987	38.883	228.529	38.994	231.072	39.111	233.617	39.233	236.165	39.361	238.714	39.495	241.265	39.633	243.817	39.780	246.372	39.930	248.928	40.087	400	
360	200.595	34.879	203.135	34.984	205.676	35.095	208.219	35.212	210.765	35.335	213.313	35.465	215.862	35.601	218.414	35.743	220.968	35.892	223.524	36.046	226.082	36.208	228.641	36.375	231.203	36.549	360	100 (P)*
350	196.152	33.956	198.692	34.063	201.234	34.177	203.779	34.298	206.326	34.425	208.874	34.558	211.445	34.698	213.979	34.844	216.534	34.997	219.091	35.156	221.650	35.322	224.211	35.494	226.774	35.673	350	
300	173.940	29.363	176.487	29.488	179.035	29.621	181.586	29.762	184.140	29.909	186.696	30.065	189.254	30.228	191.815	30.399	194.379	30.577	196.943	30.763	199.510	30.956	202.080	31.156	204.651	31.365	300	
250	151.747	24.825	154.302	24.976	156.859	25.135	159.419	25.303	161.981	25.481	164.547	25.667	167.115	25.863	169.685	26.067	172.258	26.281	174.834	26.503	177.412	26.735	179.992	26.975	182.573	27.225	250	
230	142.878	23.034	145.436	23.197	147.998	23.370	150.562	23.553	153.129	23.746	155.699	23.949	158.272	24.161	160.847	24.383	163.425	24.615	166.006	24.857	168.589	25.108	171.175	25.369	173.763	25.640	230	80 (P)*
200	129.585	20.385	132.151	20.572	134.720	20.771	137.292	20.981	139.867	21.203	142.445	21.435	145.027	21.679	147.611	21.934	150.198	22.201	152.787	22.478	155.379	22.767	157.974	23.067	160.571	23.377	200	
170	116.312	17.802	118.867	18.022	121.466	18.256	124.048	18.503	126.633	18.763	129.221	19.036	131.813	19.322	134.408	19.622	137.005	19.934	139.605	20.260	142.208	20.599	144.813	20.950	147.421	21.315	170	
155	109.686	16.547	112.267	16.789	114.851	17.045	117.439	17.315	120.030	17.600	122.624	17.900	125.222	18.213	127.823	18.541	130.446	18.883	133.032	19.240	135.641	19.610	138.252	19.995	140.866	20.394	155	65 (P)*
125	96.464	14.156	99.058	15.455	101.656	14.771	104.258	15.106	106.864	15.458	109.472	15.827	112.084	16.214	114.698	16.619	117.315	17.041	119.935	17.480	122.556	17.937	125.179	18.411	127.805	18.902	125	
100	83.491	12.366	86.100	12.738	90.713	13.131	93.329	13.547	95.948	13.984	98.569	14.443	101.193	14.923	103.820	15.425	106.447	15.948	109.076	16.492	111.706	17.056	114.337	17.642	116.968	18.248	100	
90	81.119	11.738	83.734	12.150	86.353	12.586	88.972	13.046	91.599	13.529	94.226	14.037	96.854	14.568	99.484	15.122	102.114	15.700	104.745	16.301	107.376	16.924	110.007	17.570	112.636	18.238	90	50 (P)
80	76.758	11.187	79.380	11.649	82.005	12.137	84.632	12.652	87.261	13.193	89.891	13.761	92.522	14.354	95.153	14.973	97.784	15.618	100.413	16.287	103.042	16.982	105.668	17.701	108.292	18.445	80	50 (H)**
70	72.411	10.746	75.039	11.271	77.668	11.825	80.299	12.409	82.930	13.023	85.561	13.665	88.190	14.337	90.818	15.037	93.444	15.765	96.066	16.520	98.685	17.303	101.300	18.113	103.909	18.949	70	
60	68.076	10.467	70.707	11.073	73.338	11.713	75.967	12.387	78.595	13.094	81.219	13.833	83.840	14.605	86.455	15.408	89.065	16.242	91.668	17.106	94.264	18.000	96.851	18.922	99.429	19.874	60	40 (P)*
55	65.911	10.413	68.541	11.070	71.170	11.764	73.795	12.493	76.416	13.257	79.033	14.056	81.643	14.888	84.246	15.754	86.840	16.652	89.425	17.581	92.000	18.541	94.564	19.531	97.115	20.550	55	
50	63.744	10.438	66.371	11.155	68.993	11.910	71.610	12.704	74.221	13.535	76.823	14.402	79.416	15.304	81.999	16.242	84.570	17.212	87.128	18.215	89.672	19.250	92.201	20.315	94.713	21.410	50	40 (H)**
45	61.570	10.565	64.188	11.353	66.799	12.181	69.401	13.050	71.992	13.959	74.572	14.905	77.138	15.889	79.689	16.908	82.223	17.961	84.740	19.048	87.238	20.166	89.715	21.315	92.170	22.493	45	35 (P)*
40	59.377	10.828	61.978	11.699	64.567	12.615	67.143	13.573	69.702	14.572	72.244	15.611	74.767	16.687	77.268	17.800	79.747	18.947	82.200	20.126							40	30 (H)**
35	57.142	11.274	59.712	12.247	62.263	13.266	64.792	14.329	67.298	15.434	69.778	16.578															35	
33	56.226	11.519	58.777	12.538	61.306	13.603	63.809	14.713	66.284	15.865																	33	30 (P)*
30	54.816	11.974	57.328	13.069	59.810																						30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 49°$

Deviation Angle = 49 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1146.816	247.373	1149.318	247.376	1151.819	247.380	1154.321	247.385	1156.824	247.391	1159.327	247.398	1161.830	247.406	1164.334	247.415	1166.838	247.424	1169.342	247.435	1171.846	247.446	1174.352	247.459	1176.857	247.472	2500	
2200	1010.099	217.689	1012.600	217.693	1015.102	217.698	1017.605	217.703	1020.107	217.710	1022.611	217.718	1025.114	217.727	1027.618	217.737	1030.123	217.748	1032.628	217.760	1035.133	217.772	1037.639	217.787	1040.145	217.802	2200	
2000	918.954	197.900	921.456	197.904	923.958	197.909	926.460	197.916	928.963	197.923	931.467	197.932	933.971	197.941	936.475	197.952	938.980	197.964	941.486	197.978	943.992	197.992	946.498	198.007	949.005	198.024	2000	
1800	827.809	178.111	830.311	178.116	832.813	178.121	835.316	178.128	837.819	178.137	840.323	178.146	842.828	178.157	845.333	178.169	847.838	178.183	850.344	178.197	852.851	178.213	855.358	178.230	857.865	178.249	1800	
1500	691.092	148.428	693.594	148.434	696.097	148.440	698.600	148.449	701.104	148.458	703.609	148.470	706.114	148.483	708.620	148.498	711.127	148.514	713.634	148.531	716.142	148.550	718.650	148.571	721.159	148.593	1500	
1200	554.375	118.746	556.877	118.752	559.381	118.761	561.885	118.771	564.390	118.784	566.896	118.798	569.403	118.814	571.910	118.833	574.418	118.852	576.927	118.875	579.438	118.898	581.948	118.924	584.459	118.952	1200	
1000	463.230	98.958	465.733	98.966	468.238	98.976	470.743	98.989	473.249	99.004	475.756	99.021	478.264	99.040	480.773	99.062	483.282	99.086	485.793	99.112	488.305	99.141	490.817	99.172	493.331	99.205	1000	
900	417.658	89.064	420.162	89.073	422.667	89.085	425.172	89.099	427.679	89.115	430.187	89.134	432.696	89.156	435.205	89.180	437.716	89.207	440.228	89.236	442.741	89.258	445.255	89.302	447.770	89.339	900	
800	372.086	79.171	374.590	79.181	377.095	79.194	379.602	79.209	382.109	79.228	384.618	79.250	387.128	79.274	389.639	79.301	392.151	79.331	394.665	79.364	397.179	79.400	399.695	79.438	402.211	79.480	800	
700	326.514	69.278	329.019	69.290	331.525	69.304	334.032	69.322	336.541	69.344	339.051	69.368	341.562	69.396	344.075	69.427	346.589	69.461	349.104	69.499	351.620	69.540	354.138	69.584	356.657	69.631	700	100 (P)*
600	280.943	59.386	283.448	59.399	285.955	59.416	288.464	59.437	290.974	59.462	293.485	59.490	295.999	59.523	298.513	59.559	301.029	59.599	303.547	59.643	306.066	59.691	308.587	59.742	311.109	59.798	600	
500	235.371	49.494	237.878	49.510	240.386	49.531	242.897	49.556	245.409	49.586	247.923	49.620	250.438	49.659	252.956	49.703	255.475	49.751	257.996	49.803	260.519	49.861	263.043	49.922	265.570	49.989	500	
400	189.801	39.605	192.309	39.625	194.820	39.651	197.332	39.682	199.847	39.719	202.365	39.762	204.884	39.811	207.406	39.865	209.930	39.925	212.456	39.991	214.984	40.063	217.514	40.140	220.046	40.223	400	
360	171.573	35.650	174.082	35.672	176.594	35.700	179.108	35.736	181.625	35.777	184.144	35.824	186.665	35.879	189.189	35.939	191.716	36.006	194.244	36.079	196.775	36.158	199.309	36.244	201.844	36.336	360	
330	167.016	34.661	169.525	34.684	172.037	34.713	174.552	34.750	177.069	34.792	179.589	34.841	182.111	34.896	184.635	34.959	187.162	35.027	189.692	35.103	192.224	35.184	194.758	35.272	197.295	35.367	330	
300	144.232	29.719	146.743	29.745	149.257	29.780	151.773	29.822	154.293	29.871	156.816	29.928	159.342	29.993	161.870	30.066	164.401	30.146	166.936	30.233	169.472	30.329	172.012	30.432	174.554	30.542	300	80 (P)*
250	121.448	24.778	123.961	24.810	126.478	24.851	128.998	24.902	131.522	24.961	134.049	25.030	136.579	25.108	139.113	25.195	141.650	25.291	144.190	25.396	146.734	25.510	149.281	25.634	151.830	25.766	250	
230	112.335	22.803	114.849	22.838	117.367	22.882	119.889	22.937	122.415	23.002	124.944	23.076	127.477	23.161	130.013	23.255	132.553	23.360	135.097	23.474	137.644	23.598	140.194	23.733	142.748	23.877	230	
200	98.666	19.841	101.182	19.881	103.703	19.933	106.228	19.996	108.757	20.070	111.290	20.156	113.828	20.253	116.369	20.362	118.915	20.482	121.464	20.613	124.017	20.756	126.574	20.910	129.135	21.076	200	
170	84.998	16.882	87.517	16.929	90.041	16.989	92.570	17.063	95.104	17.151	97.643	17.252	100.186	17.366	102.734	17.494	105.287	17.635	107.844	17.790	110.405	17.958	112.970	18.139	115.540	18.334	170	65 (P)*
155	78.164	15.403	80.685	15.455	83.211	15.521	85.743	15.603	88.280	15.699	90.822	15.809	93.370	15.935	95.922	16.075	98.479	16.229	101.041	16.399	103.607	16.593	106.177	16.782	108.752	16.995	155	
125	64.499	12.451	67.024	12.515	69.556	12.597	72.095	12.698	74.640	12.817	77.192	12.954	79.749	13.109	82.312	13.283	84.880	13.475	87.454	13.684	90.033	13.912	92.617	14.158	95.205	14.422	125	
100	53.114	9.998	55.645	10.078	58.185	10.181	60.732	10.307	63.287	10.455	65.849	10.626	68.418	10.820	70.994	11.037	73.576	11.276	76.164	11.538	78.758	11.822	81.357	12.129	83.960	12.458	100	
90	48.561	9.020	51.096	9.109	53.639	9.223	56.191	9.363	58.751	9.528	61.319	9.718	63.895	9.933	66.477	10.174	69.066	10.439	71.661	10.730	74.262	11.045	76.868	11.385	79.479	11.749	90	50 (P)*
80	44.009	8.045	46.548	8.145	49.096	8.273	51.654	8.430	54.220	8.616	56.795	8.830	59.378	9.072	61.968	9.342	64.565	9.640	67.168	9.966	69.777	10.320	72.391	10.701	75.010	11.110	80	50 (H)**
70	39.459	7.073	42.001	7.188	44.557	7.335	47.122	7.514	49.696	7.726	52.279	7.970	54.871	8.246	57.470	8.554	60.076	8.894	62.688	9.266	65.306	9.669	67.929	10.103	70.555	10.568	70	
60	34.911	6.106	37.461	6.242	40.023	6.413	42.597	6.622	45.181	6.869	47.774	7.153	50.376	7.475	52.986	7.833	55.602	8.228	58.224	8.660	60.851	9.128	63.482	9.631	66.116	10.170	60	40 (P)*
55	32.638	5.629	35.192	5.775	37.759	5.961	40.338	6.189	42.927	6.458	45.527	6.768	48.135	7.118	50.751	7.508	53.372	7.938	56.000	8.408	58.631	8.916	61.265	9.463	63.901	10.048	55	
50	30.366	5.153	32.925	5.313	35.497	5.518	38.082	5.769	40.678	6.064	43.284	6.404	45.899	6.788	48.520	7.217	51.148	7.688	53.780	8.202	56.414	8.759	59.051	9.357	61.668	9.996	50	40 (H)**
45	28.069	4.681	30.660	4.859	33.239	5.087	35.831	5.365	38.434	5.692	41.047	6.069	43.668	6.495	46.296	6.969	48.928	7.490	51.564	8.058	54.201	8.673	56.837	9.332	59.472	10.036	45	35 (P)*
40	25.827	4.215	28.398	4.415	30.984	4.671	33.584	4.983	36.196	5.351	38.816	5.773	41.444	6.250	44.077	6.780	46.713	7.363	49.350	7.997	51.986	8.682	54.618	9.416	57.245	10.199	40	35 (H) 30 (P)*
35	23.561	3.757	26.140	3.985	28.735	4.277	31.344	4.633	33.964	5.052	36.593	5.532	39.227	6.074	41.863	6.675	44.500	7.335	47.133	8.051	49.761	8.823	52.381	9.650	54.990	10.528	35	
33	22.055	3.577	25.238	3.818	27.837	4.128	30.450	4.505	33.074	4.948	35.705	5.456	38.341	6.029	40.978	6.664	43.613	7.360	46.243	8.116	48.865	8.929	51.476	9.798	54.073	10.720	33	
30	21.298	3.311	23.887	3.577	26.493	3.916	29.112	4.330	31.741	4.816	34.376	5.372	37.013	5.998	39.648	6.691	42.277	7.449	44.898	8.271	47.506	9.153	50.097	10.094	52.669	11.090	30	30 (H)**
25	19.141	2.884	21.642	3.202	24.260	3.608	26.890	4.101	29.525	4.679	32.162	5.338	34.793	6.077	37.415	6.893	40.021	7.781	42.607	8.738	45.168	9.761	47.699	10.846	50.195	11.987	25	
23	18.140	2.722	20.747	3.067	23.370	3.507	26.003	4.041	28.640	4.665	31.274	5.376	33.899	6.172	36.508	7.048	39.096	8.000	41.656	9.023	44 184	10.112	46.674	11.263			23	25 (P)*
20	16.792	2.492	19.408	2.887	22.039	3.390	24.675	3.999	27.309	4.708	29.932	5.514	32.536	6.411	35.113	7.394	37.655	8.455	40.156	9.589							20	25 (H)**
15	14.556	2.165	17.188	2.686	19.824	3.345	23.449	4.136	25.049	5.047	27.609	6.070	30.117	7.192													15	20 (P)*
14	14.111	2.114	16.745	2.670	19.379	3.372	21.996	4.211	24.579	5.176	27.113	6.253															14	20 (H)**

*P - Plain & Rolling Terrian **H - Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 49 Degrees

$\Delta = 49°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=123 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1179.363	247.486	1181.869	247.501	1184.376	247.517	1186.883	247.534	1189.390	247.552	1191.898	247.571	1194.406	247.590	1196.914	247.611	1199.423	247.633	1201.932	247.655	1204.442	247.678	1206.951	247.703	1209.462	247.728	2500	
2200	1042.652	217.818	1045.159	217.835	1047.666	217.853	1050.174	217.872	1052.682	217.893	1055.191	217.914	1057.700	217.937	1060.210	217.960	1062.720	217.984	1065.230	218.010	1067.741	218.036	1070.252	218.064	1072.763	218.092	2200	
2000	951.512	198.042	954.020	198.061	956.528	198.080	959.036	198.102	961.546	198.124	964.055	198.147	966.565	198.172	969.076	198.198	971.587	198.225	974.098	198.253	976.610	198.282	979.122	198.312	981.635	198.344	2000	
1800	860.373	178.268	862.882	178.289	865.391	178.312	867.901	178.335	870.411	178.360	872.921	178.386	875.432	178.413	877.944	178.442	880.456	178.472	882.969	178.503	885.482	178.535	887.996	178.569	890.510	178.604	1800	
1500	723.669	148.617	726.179	148.642	728.690	148.669	731.202	148.697	733.713	148.727	736.226	148.758	738.740	148.791	741.253	148.825	743.768	148.861	746.283	148.898	748.799	148.937	751.315	148.978	753.832	149.020	1500	
1200	586.971	118.981	589.484	119.013	591.997	119.046	594.511	119.081	597.026	119.119	599.542	119.158	602.059	119.199	604.576	119.242	607.094	119.287	609.613	119.333	612.132	119.382	614.652	119.432	617.173	119.485	1200	
1000	495.845	99.240	498.361	99.278	500.877	99.318	503.394	99.361	505.912	99.406	508.430	99.452	510.950	99.501	513.471	99.553	515.992	99.607	518.514	99.663	521.038	99.721	523.562	99.782	526.086	99.845	1000	
900	450.286	89.378	452.802	89.420	455.321	89.465	457.839	89.512	460.359	89.562	462.880	89.614	465.402	89.668	467.924	89.725	470.448	89.785	472.973	89.847	475.499	89.912	478.025	89.980	480.552	90.050	900	
800	404.729	79.524	407.248	79.572	409.768	79.622	412.289	79.675	414.812	79.730	417.335	79.789	419.859	79.851	422.385	79.915	424.911	79.982	427.439	80.052	429.967	80.125	432.497	80.201	435.028	80.280	800	
700	359.177	69.682	361.699	69.736	364.222	69.793	366.746	69.854	369.271	69.917	371.797	69.984	374.325	70.054	376.854	70.128	379.384	70.205	381.915	70.285	384.448	70.368	386.981	70.455	389.516	70.545	700	
600	313.632	59.857	316.157	59.920	318.683	59.987	321.211	60.057	323.740	60.132	326.271	60.210	328.803	60.292	331.336	60.378	333.871	60.467	336.407	60.561	338.945	60.658	341.483	60.759	344.024	60.864	600	
500	268.097	50.060	270.627	50.135	273.158	50.215	275.691	50.300	278.226	50.389	280.762	50.483	283.300	50.581	285.840	50.684	288.381	50.792	290.923	50.904	293.468	51.021	296.014	51.142	298.561	51.267	500	
400	222.581	40.312	225.117	40.406	227.656	40.506	230.196	40.612	232.739	40.723	235.283	40.840	237.830	40.963	240.378	41.092	242.928	41.226	245.481	41.366	248.035	41.512	250.591	41.663	253.148	41.820	400	
360	204.382	36.435	206.922	36.540	209.465	36.651	212.010	36.768	214.556	36.892	217.105	37.022	219.656	37.159	222.209	37.302	224.765	37.451	227.322	37.606	229.881	37.768	232.442	37.936	235.006	38.111	360	100 (P)*
350	199.834	35.469	202.375	35.576	204.918	35.691	207.464	35.812	210.012	35.939	212.562	36.073	215.115	36.213	217.669	36.360	220.226	36.513	222.784	36.673	225.345	36.840	227.908	37.013	230.473	37.192	350	
300	177.099	30.661	179.646	30.786	182.196	30.919	184.749	31.061	187.304	31.209	189.861	31.365	192.421	31.529	194.983	31.700	197.548	31.879	200.115	32.065	202.684	32.259	205.255	32.461	207.829	32.670	300	
250	154.383	25.908	156.939	26.059	159.497	26.219	162.059	26.388	164.621	26.566	167.190	26.753	169.760	26.949	172.333	27.155	174.908	27.369	177.486	27.592	180.066	27.825	182.648	28.066	185.233	28.317	250	
230	145.304	24.031	147.864	24.195	150.427	24.368	152.993	24.552	155.562	24.745	158.134	24.949	160.709	25.162	163.287	25.385	165.867	25.618	168.450	25.860	171.036	26.113	173.624	26.375	176.214	26.647	230	80 (P)*
200	131.699	21.253	134.266	21.441	136.837	21.641	139.411	21.852	141.988	22.074	144.569	22.307	147.153	22.552	149.739	22.808	152.328	23.076	154.921	23.354	157.515	23.644	160.113	23.945	162.713	24.257	200	
175	118.113	18.542	120.690	18.763	123.271	18.997	125.855	19.245	128.443	19.506	131.034	19.781	133.629	20.068	136.226	20.369	138.826	20.683	141.430	21.009	144.036	21.349	146.644	21.702	149.256	22.068	175	
155	111.331	17.223	113.914	17.466	116.501	17.723	119.091	17.994	121.685	18.280	124.282	18.581	126.883	18.895	129.487	19.225	132.094	19.568	134.703	19.926	137.316	20.298	139.931	20.685	142.548	21.085	155	65 (P)*
125	97.798	14.704	100.396	15.004	102.997	15.322	105.602	15.657	108.211	16.011	110.823	16.382	113.438	16.770	116.056	17.177	118.677	17.600	121.301	18.041	123.927	18.500	126.555	18.975	129.185	19.468	125	
100	86.569	12.809	89.181	13.182	91.798	13.577	94.418	13.994	97.041	14.433	99.667	14 894	102.296	15.376	104.926	15.879	107.559	16.404	110.193	16.950	112.829	17.517	115.465	18.105	118.102	18.714	100	
90	82.094	12.139	84.714	12.552	87.337	12.990	89.963	13.452	92.592	13.937	95.223	14.447	97.857	14.980	100.492	15.537	103.128	16.116	105.764	16.719	108.401	17.345	111.038	17.994	113.674	18.665	90	50 (P)
80	77.633	11.546	80.259	12.010	82.889	12.500	85.521	13.017	88.155	13.560	90.790	14.130	93.427	14.726	96.064	15.347	98.701	15.994	101.337	16.667	103.972	17.364	106.605	18.086	109.236	18.832	80	30 (H)**
70	73.185	11.064	75.818	11.591	78.453	12.147	81.089	12.734	83.726	13.350	86.363	13.995	88.999	14.669	91.634	15.372	94.266	16.103	96.896	16.861	99.522	17.647	102.145	18.460	104.762	19.299	70	
60	68.752	10.744	71.389	11.353	74.025	11.996	76.661	12.672	79.296	13.382	81.927	14.124	84.555	14.899	87.178	15.705	89.796	16.542	92.408	17.410	95.012	18.307	97.608	19.233	100.195	20.188	60	40 (P)*
55	66.538	10.671	69.175	11.331	71.810	12.027	74.442	12.759	77.071	13.526	79.695	14.328	82.313	15.164	84.924	16.032	87.527	16.934	90.122	17.867	92.706	18.831	93.279	19.824	97.839	20.848	55	
50	64.324	10.676	66.957	11.396	69.587	12.154	72.212	12.951	74.830	13.785	77.441	14.656	80.043	15.562	82.634	16.502	85.215	17.477	87.782	18.484	90.336	19.523	92.873	20.592	95.397	21.691	50	40 (H)**
45	62.103	10.784	64.728	11.575	67.347	12.407	69.957	13.279	72.558	14.191	75.146	15.141	77.722	16.128	80.283	17.152	82.827	18.209	85.355	19.300	87.863	20.423	90.351	21.576	92.817	22.759	45	35 (P)*
40	59.864	11.028	62.474	11.903	65.072	12.822	67.657	13.784	70.226	14.787	72.778	15.830	75.311	16.911	77.823	18.027	80.312	19.179	82.777	20.363							40	30 (H)**
35	57.585	11.456	60.165	12.433	62.726	13.456	65.265	14.523	67.782	15.632	70.273	16.781															35	
33	56.633	11.694	59.214	12.717	61.753	13.787	64.266	14.901	66.752	16.057																	33	30 (P)*
30	55.218	12.139	57.741	13.238	60.234	14.384																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 50 Degrees **$\Delta = 50°$**

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	1173.270	258.448	1175.771	258.451	1178.273	258.455	1180.775	258.460	1183.278	258.466	1185.781	258.473	1188.284	258.480	1190.788	258.490	1193.292	258.499	1195.796	258.510	1198.301	258.521	1200.806	258.534	1203.312	258.547	2500	
2200	1033.378	227.435	1035.880	227.438	1038.382	227.443	1040.884	227.449	1043.387	227.456	1045.890	227.464	1048.394	227.472	1050.898	227.482	1053.403	227.493	1055.907	227.505	1058.413	227.519	1060.919	227.532	1063.425	227.548	2200	
2000	940.117	206.760	942.618	206.764	945.121	206.769	947.623	206.775	950.126	206.783	952.630	206.792	955.134	206.801	957.639	206.812	960.144	206.824	962.649	206.837	965.156	206.852	967.662	206.867	970.169	206.884	2000	
1800	846.855	186.085	849.357	186.089	851.860	186.095	854.363	186.102	856.866	186.110	859.370	186.120	861.875	186.131	864.380	186.143	866.885	186.156	869.392	186.171	871.898	186.187	874.406	186.205	876.913	186.223	1800	
1500	706.964	155.073	709.466	155.078	711.969	155.085	714.473	155.094	716.977	155.104	719.482	155.115	721.987	155.128	724.493	155.143	727.000	155.159	729.507	155.177	732.015	155.196	734.524	155.216	737.033	155.239	1500	
1200	567.072	124.062	569.575	124.068	572.079	124.077	574.583	124.087	577.089	124.100	579.594	124.114	582.101	124.130	584.609	124.149	587.117	124.169	589.626	124.191	592.136	124.215	594.647	124.240	597.159	124.268	1200	
1000	473.812	103.388	476.315	103.396	478.820	103.406	481.325	103.419	483.831	103.434	486.338	103.451	488.846	103.470	491.355	103.492	493.865	103.516	496.376	103.543	498.888	103.572	501.401	103.603	503.915	103.636	1000	
900	427.181	93.051	429.685	93.060	432.190	93.072	434.696	93.086	437.203	93.102	439.711	93.121	442.220	93.143	444.730	93.167	447.241	93.194	449.753	93.224	452.266	93.255	454.781	93.290	457.296	93.327	900	
800	380.551	82.715	383.055	82.725	385.561	82.738	388.067	82.754	390.575	82.772	393.084	82.794	395.594	82.818	398.106	82.845	400.618	82.876	403.132	82.909	405.647	82.945	408.163	82.983	410.680	83.025	800	100 (P)*
700	333.921	72.379	336.426	72.391	338.932	72.405	341.440	72.423	343.949	72.445	346.459	72.469	348.971	72.497	351.483	72.528	353.998	72.563	356.513	72.601	359.030	72.642	361.548	72.686	364.068	72.733	700	
600	287.292	62.044	289.797	62.057	292.304	62.074	294.813	62.095	297.323	62.120	299.835	62.149	302.349	62.182	304.864	62.218	307.380	62.258	309.898	62.302	312.418	62.350	314.939	62.402	317.462	62.458	600	
500	240.662	51.709	243.169	51.726	245.678	51.746	248.188	51.771	250.701	51.801	253.215	51.836	255.731	51.875	258.249	51.918	260.768	51.967	263.290	52.020	265.813	52.077	268.338	52.139	270.865	52.206	500	
400	194.034	41.377	196.542	41.397	199.053	41.423	201.566	41.454	204.081	41.492	206.599	41.535	209.119	41.584	211.641	41.638	214.165	41.698	216.692	41.765	219.221	41.836	221.752	41.914	224.285	41.997	400	
360	175.383	37.245	177.892	37.267	180.404	37.296	182.918	37.331	185.435	37.372	187.955	37.420	190.477	37.474	193.002	37.535	195.529	37.602	198.058	37.675	200.590	37.755	203.124	37.841	205.661	37.934	360	
320	170.720	36.212	123.229	36.235	173.742	36.264	179.257	36.300	180.774	36.343	183.294	36.392	185.817	36.448	188.342	36.510	190.870	36.579	193.400	36.655	195.933	36.737	198.468	36.825	201.005	36.921	320	
300	147.407	31.048	149.918	31.075	152.432	31.109	154.949	31.151	157.470	31.201	159.993	31.258	162.519	31.323	165.048	31.396	167.580	31.477	170.115	31.565	172.653	31.660	175.193	31.764	177.737	31.875	300	80 (P)*
250	124.094	23.886	126.607	25.918	129.124	25.959	131.645	26.010	134.169	26.070	136.697	26.138	139.228	26.217	141.763	26.304	144.301	26.400	146.842	26.506	149.387	26.621	151.935	26.745	154.486	26.878	250	
230	114.769	23.822	117.284	23.857	119.802	23.902	122.325	23.957	124.851	24.022	127.381	24.097	129.915	24.181	132.452	24.276	134.993	24.381	137.538	24.495	140.085	24.621	142.637	24.755	145.192	24.900	230	
200	100.783	20.727	103.299	20.767	105.821	20.819	108.346	20.882	110.876	20.957	113.410	21.043	115.949	21.141	118.491	21.250	121.038	21.370	123.588	21.502	126.143	21.646	128.701	21.801	131.263	21.967	200	65 (P)*
170	86.797	17.635	89.317	17.682	91.841	17.743	94.371	17.817	96.906	17.905	99.446	18.007	101.990	18.121	104.540	18.250	107.094	18.391	109.652	18.547	112.215	18.715	114.782	18.897	117.353	19.093	170	
155	79.805	16.090	82.326	16.142	84.853	16.209	87.386	16.290	89.924	16.387	92.467	16.498	95.015	16.624	97.569	16.764	100.128	16.920	102.691	17.090	105.259	17.275	107.831	17.474	110.408	17.688	155	
125	65.872	13.005	68.348	13.069	70.881	13.152	73.421	13.253	75.967	13.372	78.520	13.510	81.079	13.666	83.643	13.840	86.213	14.033	88.789	14.243	91.370	14.472	93.957	14.719	96.548	14.984	125	
100	54.173	10.441	56.705	10.522	59.246	10.625	61.794	10.751	64.351	10.900	66.915	11.072	69.486	11.267	72.063	11.485	74.648	11.725	77.238	11.988	79.834	12.273	82.436	12.581	85.043	12.911	100	
90	49.514	9.419	52.050	9.508	54.594	9.623	57.148	9.763	59.710	9.929	62.280	10.120	64.857	10.336	67.442	10.577	70.033	10.844	72.631	11.135	75.235	11.452	77.844	11.794	80.459	12.160	90	50 (P)*
80	44.857	8.399	47.396	8.500	49.946	8.629	52.505	8.787	55.074	8.973	57.651	9.188	60.236	9.431	62.828	9.703	65.428	10.001	68.034	10.329	70.647	10.684	73.264	11.067	75.887	11.477	80	50 (H)**
70	40.201	7.384	42.746	7.499	45.302	7.646	47.868	7.827	50.444	8.039	53.030	8.284	55.624	8.561	58.226	8.871	60.836	9.215	63.451	9.595	66.073	10.009	68.700	10.456	71.331	10.893	70	
60	35.547	6.375	38.099	6.509	40.662	6.681	43.238	6.891	45.824	7.138	48.421	7.424	51.026	7.747	53.639	8.106	56.259	8.503	58.886	8.937	61.517	9.406	64.153	9.912	66.792	10.453	60	40 (P)*
55	33.222	5.874	35.777	6.020	38.346	6.207	40.927	6.436	43.519	6.706	46.122	7.017	48.733	7.368	51.352	7.760	53.978	8.192	56.610	8.663	59.246	9.174	61.886	9.723	64.528	10.310	55	
50	30.897	5.376	33.457	5.536	36.032	5.742	38.619	5.994	41.218	6.290	43.827	6.632	46.446	7.017	49.071	7.447	51.703	7.920	54.340	8.437	56.980	8.996	59.623	9.596	62.266	10.238	50	40 (H)**
45	28.574	4.882	31.140	5.060	33.721	5.289	36.315	5.568	38.922	5.897	41.539	6.275	44.164	6.702	46.796	7.178	49.434	7.702	52.075	8.275	54.717	8.889	57.360	9.551	60.002	10.238	45	35 (P)*
40	26.253	4.393	28.825	4.594	31.414	4.851	34.017	5.164	36.632	5.533	39.257	5.958	41.890	6.436	44.528	6.969	47.169	7.554	49.812	8.191	52.455	8.878	55.094	9.615	57.728	10.401	40	35 (H) 30 (P)*
35	23.934	3.913	26.515	4.142	29.113	4.435	31.726	4.793	34.350	5.213	36.983	5.696	39.622	6.239	42.264	6.843	44.907	7.505	47.548	8.225	50.183	9.000	52.811	9.830	55.428	10.711	35	
33	23.007	3.724	25.592	3.967	28.195	4.278	30.811	4.656	33.439	5.101	36.076	5.611	38.717	6.186	41.360	6.824	44.001	7.523	46.639	8.281	49.268	9.098	51.888	9.970	54.494	10.896	33	
30	21.619	3.445	24.210	3.712	26.820	4.053	29.443	4.468	32.076	4.956	34.717	5.515	37.359	6.143	40.001	6.839	42.638	7.600	45.267	8.425	47.883	9.311	50.484	10.256	53.065	11.256	30	30 (H)**
25	19.310	2.997	21.914	3.316	24.536	3.724	27.170	4.218	29.811	4.798	32.454	5.465	35.093	6.202	37.732	7.021	40.337	7.913	42.932	8.874	45.503	9.902	48.044	10.990	50.551	12.136	25	
23	18.388	2.826	20.998	3.172	23.625	3.614	26.264	4.150	28.906	4.776	31.547	5.491	34.179	6.290	36.797	7.169	39.394	8.125	41.965	9.152	44.503	10.246	47.004	11.401			23	25 (P)*
20	17.009	2.582	19.629	2.979	22.264	3.484	24.906	4.095	27.547	4.808	30.178	5.617	32.790	6.518	35.377	7.504	37.929	8.570	40.441	9.709							20	25 (H)**
15	14.721	2.234	17.358	2.757	20.001	3.419	22.633	4.213	25.242	5.128	27.812	6.155	30.331	7.282													15	20 (P)*
14	14.266	2.179	16.906	2.737	19.547	3.442	22.171	4.285	24.764	5.253	27.308	6.335															14	20 (H)**

*P – Plain & Rolling Terrain **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 50 Degrees

$\Delta = 50°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1205.818	258.561	1208.324	258.576	1210.831	258.592	1213.338	258.609	1215.845	258.627	1218.353	258.646	1220.861	258.666	1223.370	258.687	1225.879	258.708	1228.388	258.731	1230.898	258.754	1233.408	258.779	1235.919	258.804	2500	
2200	1065.932	227.564	1068.439	227.581	1070.947	227.599	1073.455	227.619	1075.964	227.639	1078.472	227.660	1080.982	227.683	1083.492	227.707	1086.002	227.731	1088.512	227.757	1091.023	227.783	1093.535	227.811	1096.047	227.840	2200	
2000	972.676	206.902	975.184	206.921	977.692	206.941	980.201	206.962	982.711	206.984	985.220	207.008	987.731	207.033	990.241	207.059	992.753	207.086	995.264	207.114	997.777	207.143	1000.289	207.174	1002.802	207.205	2000	
1800	879.421	186.243	881.930	186.264	884.439	186.286	886.949	186.310	889.460	186.334	891.971	186.361	894.482	186.388	896.994	186.417	899.506	186.447	902.019	186.478	904.532	186.511	907.047	186.545	909.561	186.580	1800	
1500	739.543	155.262	742.053	155.287	744.565	155.314	747.076	155.343	749.589	155.373	752.102	155.404	754.615	155.437	757.129	155.471	759.644	155.507	762.160	155.545	764.677	155.584	767.192	155.625	769.710	155.667	1500	
1200	599.671	124.298	602.184	124.330	604.698	124.363	607.212	124.398	609.728	124.436	612.244	124.475	614.761	124.516	617.279	124.560	619.797	124.604	622.316	124.651	624.836	124.700	627.357	124.751	629.878	124.803	1200	
1000	506.429	103.671	508.945	103.709	511.462	103.750	513.979	103.792	516.498	103.837	519.017	103.884	521.537	103.934	524.058	103.985	526.580	104.039	529.103	104.095	531.626	104.154	534.151	104.215	536.677	104.278	1000	
900	459.812	93.367	462.329	93.409	464.848	93.453	467.367	93.500	469.887	93.550	472.409	93.603	474.931	93.657	477.454	93.715	479.979	93.775	482.504	93.837	485.030	93.903	487.557	93.970	490.085	94.041	900	
800	413.198	83.070	415.717	83.117	418.238	83.167	420.759	83.220	423.282	83.276	425.806	83.335	428.331	83.397	430.857	83.462	433.384	83.529	435.913	83.600	438.442	83.673	440.972	83.749	443.504	83.828	800	
700	366.588	72.784	369.110	72.839	371.634	72.896	374.158	72.957	376.684	73.021	379.211	73.088	381.740	73.158	384.269	73.233	386.800	73.310	389.332	73.390	391.865	73.474	394.400	73.561	396.936	73.651	700	
600	319.986	62.517	322.511	62.580	325.038	62.647	327.567	62.718	330.097	62.792	332.628	62.871	335.161	62.953	337.695	63.040	340.230	63.129	342.768	63.223	345.306	63.321	347.846	63.422	350.387	63.527	600	
500	273.394	52.277	275.924	52.353	278.456	52.433	280.990	52.518	283.525	52.608	286.063	52.702	288.601	52.801	291.142	52.904	293.684	53.012	296.228	53.125	298.773	53.242	301.321	53.363	303.869	53.490	500	
400	226.820	42.086	229.358	42.161	231.897	42.241	234.439	42.388	236.982	42.500	239.528	42.617	242.076	42.741	244.625	42.870	247.177	43.005	249.730	43.145	252.286	43.292	254.843	43.443	257.403	43.601	400	100 (P)*
360	208.199	38.033	210.741	38.138	213.284	38.250	215.830	38.368	218.378	38.492	220.928	38.623	223.480	38.760	226.035	38.903	228.592	39.053	231.150	39.209	233.711	39.372	236.274	39.540	238.839	39.715	360	
350	203.345	37.022	206.088	37.131	208.632	37.245	211.179	37.367	213.728	37.495	216.280	37.629	218.833	37.770	221.389	37.918	223.947	38.072	226.508	38.232	229.070	38.399	231.634	38.573	234.201	38.753	350	
300	180.283	31.993	182.831	32.120	185.383	32.253	187.937	32.395	190.493	32.544	193.052	32.701	195.613	32.865	198.177	33.037	200.744	33.217	203.312	33.404	205.883	33.599	208.457	33.801	211.032	34.011	300	
250	157.040	27.020	159.597	27.172	162.157	27.332	164.720	27.502	167.286	27.681	169.855	27.869	172.427	28.066	175.001	28.272	177.579	28.487	180.158	28.711	182.741	28.945	185.326	29.187	187.913	29.439	250	
230	147.750	25.055	150.312	25.219	152.877	25.394	155.444	25.578	158.015	25.772	160.589	25.976	163.166	26.190	165.746	26.414	168.328	26.648	170.914	26.892	173.502	27.145	176.092	27.408	178.685	27.682	230	80 (P)*
200	133.829	22.145	136.398	22.334	138.971	22.534	141.547	22.746	144.127	22.969	146.710	23.204	149.295	23.449	151.884	23.707	154.476	23.975	157.071	24.255	159.669	24.546	162.269	24.848	164.872	25.161	200	
170	119.929	19.302	122.508	19.524	125.091	19.759	127.678	20.008	130.268	20.270	132.862	20.546	135.459	20.834	138.059	21.136	140.662	21.451	143.269	21.779	145.878	22.121	148.490	22.475	151.105	22.843	170	
155	112.989	17.917	115.575	18.161	118.164	18.419	120.757	18.691	123.354	18.979	125.954	19.280	128.558	19.596	131.165	19.927	133.775	20.272	136.388	20.631	139.004	21.005	141.622	21.393	144.243	21.795	155	65 (P)*
125	99.143	15.267	101.744	15.569	104.348	15.888	106.956	16.224	109.568	16.579	112.184	16.952	114.803	17.342	117.425	17.750	120.051	18.175	122.678	18.618	125.309	19.078	127.941	19.556	130.576	20.051	125	
100	87.655	13.263	90.271	13.638	92.891	14.035	95.515	14.454	98.143	14.894	100.773	15.357	103.407	15.841	106.042	16.347	108.680	16.874	111.320	17.422	113.960	17.991	116.602	18.581	119.245	19.193	100	
90	83.078	12.550	85.701	12.965	88.328	13.405	90.959	13.869	93.593	14.356	96.229	14.868	98.868	15.403	101.508	15.962	104.150	16.544	106.792	17.149	109.435	17.778	112.078	18.429	114.721	19.103	90	50 (P)
80	78.514	11.915	81.145	12.381	83.779	12.873	86.416	13.392	89.056	13.937	91.697	14.509	94.339	15.108	96.982	15.732	99.625	16.381	102.268	17.056	104.909	17.756	107.549	18.481	110.188	19.231	80	50 (H)**
70	73.966	11.391	76.604	11.920	79.244	12.478	81.886	13.067	84.529	13.686	87.172	14.334	89.814	15.010	92.456	15.716	95.095	16.450	97.732	17.211	100.366	18.000	102.996	18.816	105.622	19.659	70	
60	69.433	11.029	72.076	11.641	74.719	12.286	77.361	12.965	80.002	13.678	82.641	14.423	85.276	15.201	87.907	16.010	90.533	16.851	93.153	17.722	95.766	18.623	98.371	19.553	100.967	20.511	60	40 (P)*
55	67.171	10.936	69.813	11.598	72.455	12.397	75.095	13.032	77.731	13.802	80.363	14.607	82.989	15.446	85.608	16.319	88.220	17.224	90.823	18.170	93.416	19.128	95.999	20.126	98.570	21.153	55	
50	64.908	10.921	67.548	11.643	70.185	12.405	72.818	13.205	75.444	14.042	78.063	14.916	80.674	15.826	83.275	16.770	85.864	17.749	88.442	18.760	91.005	19.803	93.555	20.877	96.088	21.980	50	40 (H)**
45	62.640	11.069	65.273	11.803	67.900	12.638	70.519	13.514	73.128	14.430	75.725	15.384	78.310	16.375	80.881	17.402	83.436	18.464	85.964	19.559	88.493	20.687	90.992	21.845	93.470	23.032	45	35 (P)*
40	60.355	11.234	62.974	12.112	65.581	13.035	68.174	14.001	70.753	15.008	73.315	16.055	75.859	17.140	78.381	18.261	80.882	19.417	83.358	20.606							40	30 (H)**
35	58.033	11.643	60.621	12.624	63.192	13.651	65.742	14.723	68.269	14.837	70.771	16.990															35	
33	57.084	11.874	59.654	12.901	62.203	13.975	64.727	15.094	67.225	16.255																	33	30 (P)*
30	55.624	12.309	58.157	13.413	60.661	14.563																					30	90 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P= Plain & Rolling Terrain **H= Mountainous & Steep Terrain

Appendix 3

△=51°

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 51 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1199.940	269.825	1202.441	269.828	1204.943	269.832	1207.445	269.837	1209.948	269.844	1212.450	269.850	1214.954	269.858	1217.458	269.867	1219.962	269.877	1222.466	269.887	1224.971	269.899	1227.477	269.911	1229.982	269.925	2500	
2200	1056.847	237.447	1059.349	237.451	1061.851	237.455	1064.354	237.461	1066.856	237.468	1069.360	237.476	1071.864	237.485	1074.368	237.495	1076.872	237.506	1079.377	237.518	1081.883	237.531	1084.389	237.545	1086.896	237.560	2200	
2000	961.452	215.862	963.954	215.866	966.457	215.871	968.959	215.877	971.462	215.885	973.966	215.894	976.470	215.903	978.975	215.914	981.480	215.926	983.986	215.940	986.492	215.954	988.999	215.970	991.506	215.986	2000	
1800	866.058	194.277	868.560	194.281	871.062	194.287	873.565	194.294	876.069	194.302	878.573	194.312	881.078	194.323	883.583	194.335	886.088	194.349	888.595	194.363	891.102	194.379	893.609	194.397	896.117	194.415	1800	
1500	722.966	161.899	725.468	161.905	727.971	161.912	730.475	161.920	732.979	161.930	735.484	161.942	737.989	161.955	740.496	161.969	743.002	161.985	745.510	162.003	748.018	162.022	750.527	162.043	753.037	162.065	1500	
1200	579.874	129.523	582.377	129.529	584.881	129.538	587.385	129.549	589.890	129.561	592.396	129.576	594.904	129.592	597.411	129.610	599.920	129.630	602.429	129.652	604.939	129.677	607.450	129.702	609.962	129.730	1200	
1000	484.479	107.938	486.983	107.947	489.488	107.957	491.993	107.970	494.499	107.985	497.007	108.002	499.515	108.022	502.024	108.044	504.534	108.068	507.046	108.094	509.558	108.123	512.071	108.154	514.585	108.188	1000	
900	436.783	97.147	439.286	97.156	441.792	97.168	444.297	97.182	446.804	97.198	449.313	97.217	451.822	97.239	454.332	97.264	456.844	97.291	459.356	97.320	461.869	97.352	464.384	97.387	466.900	97.424	900	
800	389.086	86.356	391.590	86.366	394.096	86.379	396.602	86.395	399.110	86.413	401.619	86.435	404.130	86.459	406.641	86.487	409.154	86.517	411.668	86.550	414.183	86.586	416.700	86.625	419.217	86.667	800	
700	341.389	75.565	343.894	75.576	346.400	75.591	348.908	75.609	351.417	75.631	353.927	75.656	356.439	75.683	358.953	75.715	361.467	75.749	363.983	75.787	366.500	75.828	369.019	75.873	371.599	75.921	700	100 (P)*
600	293.693	64.774	296.198	64.788	298.706	64.805	301.215	64.826	303.725	64.851	306.237	64.880	308.751	64.913	311.266	64.949	313.783	64.990	316.302	65.034	318.822	65.082	321.344	65.134	323.866	65.190	600	
500	245.996	53.985	248.503	54.001	251.012	54.022	253.523	54.047	256.036	54.077	258.550	54.112	261.067	54.151	263.585	54.195	266.105	54.243	268.627	54.297	271.151	54.354	273.677	54.417	276.204	54.483	500	
400	198.301	43.197	200.810	43.218	203.321	43.244	205.834	43.275	208.350	43.313	210.868	43.356	213.388	43.405	215.911	43.460	218.436	43.520	220.963	43.587	223.493	43.659	226.025	43.737	228.558	43.820	400	
360	179.223	38.883	181.733	38.906	184.245	38.934	186.760	38.970	189.277	39.011	191.797	39.059	194.320	39.114	196.845	39.175	199.373	39.242	201.903	39.316	204.435	39.396	206.970	39.482	209.508	39.575	360	
350	174.454	37.805	176.964	37.828	179.476	37.857	181.992	37.894	184.509	37.936	187.030	37.986	189.553	38.042	192.079	38.103	194.607	38.174	197.138	38.250	199.672	38.332	202.208	38.421	204.746	38.517	350	
300	150.607	32.413	153.119	32.440	155.633	32.475	158.151	32.517	160.672	32.567	163.196	32.625	165.722	32.690	168.252	32.763	170.785	32.844	173.321	32.932	175.860	33.029	178.401	33.132	180.945	33.243	300	80 (P)*
250	126.761	27.024	129.275	27.056	131.792	27.097	134.314	27.148	136.838	27.208	139.367	27.277	141.899	27.356	144.434	27.444	146.973	27.541	149.515	27.646	152.061	27.762	154.610	27.886	157.162	28.020	250	
230	117.223	24.869	119.738	24.904	122.257	24.949	124.780	25.004	127.307	25.069	129.837	25.145	132.372	25.230	134.910	25.325	137.452	25.430	139.998	25.546	142.547	25.671	145.100	25.806	147.657	25.951	230	
200	102.917	21.638	105.434	21.678	107.955	21.730	110.482	21.793	113.012	21.868	115.547	21.955	118.087	22.053	120.630	22.162	123.178	22.283	125.730	22.416	128.286	22.560	130.846	22.715	133.409	22.882	200	
170	86.612	18.409	91.131	18.456	93.657	18.517	96.187	18.592	98.723	18.680	101.264	18.782	103.809	18.897	106.360	19.026	108.915	19.168	111.475	19.324	114.040	19.494	116.608	19.676	119.181	19.873	170	65 (P)*
150	81.459	16.796	83.981	16.848	86.509	16.915	89.042	16.997	91.581	17.094	94.125	17.205	96.675	17.332	99.230	17.473	101.790	17.629	104.355	17.800	106.924	17.985	109.499	18.186	112.078	18.401	155	
125	67.157	13.574	69.683	13.639	72.217	13.722	74.758	13.823	77.305	13.943	79.859	14.081	82.419	14.238	84.986	14.413	87.558	14.606	90.136	14.818	92.719	15.048	95.308	15.296	97.901	15.562	125	
100	53.241	10.697	55.774	10.977	60.315	11.081	62.865	11.208	65.423	11.358	67.988	11.530	70.561	11.726	73.141	11.944	75.728	12.186	78.321	12.449	80.920	12.736	83.525	13.045	86.135	13.377	100	
90	50.476	9.829	53.012	9.919	55.558	10.034	58.112	10.175	60.676	10.341	63.248	10.533	65.827	10.750	68.414	10.992	71.008	11.260	73.609	11.553	76.216	11.871	78.828	12.213	81.446	12.581	90	50 (P)*
80	45.712	8.764	48.232	8.865	50.803	8.995	53.364	9.153	55.934	9.340	58.513	9.555	61.100	9.799	63.696	10.072	66.298	10.372	68.908	10.701	71.523	11.038	74.145	11.443	76.771	11.855	80	50 (H)**
70	40.949	7.703	43.495	7.819	46.052	7.967	48.620	8.148	51.199	8.361	53.787	8.607	56.384	8.885	58.989	9.196	61.602	9.539	64.221	9.914	66.846	10.320	69.476	10.758	72.113	11.227	70	
60	36.189	6.649	38.742	6.783	41.307	6.956	43.885	7.167	46.474	7.415	49.073	7.702	51.681	8.026	54.298	8.387	56.922	8.786	59.552	9.221	62.188	9.693	64.829	10.200	67.473	10.744	60	40 (P)*
55	33.810	6.124	36.367	6.271	38.938	6.460	41.521	6.689	44.116	6.961	46.721	7.273	49.336	7.626	51.959	8.019	54.589	8.453	57.226	8.926	59.867	9.438	62.512	9.990	65.159	10.580	55	
50	31.432	5.604	33.994	5.765	36.571	5.972	39.160	6.225	41.762	6.522	44.375	6.865	46.997	7.253	49.627	7.684	52.263	8.159	54.905	8.678	57.551	9.239	60.199	9.842	62.848	10.487	50	40 (H)**
45	29.096	5.087	31.624	5.266	34.207	5.496	36.804	5.726	39.414	6.107	42.035	6.487	44.664	6.916	47.301	7.393	49.947	7.919	52.599	8.492	55.258	9.111	57.868	9.776	60.536	10.466	45	35 (P)*
40	26.682	4.576	29.257	4.778	31.848	5.036	34.454	5.351	37.072	5.721	39.701	6.147	42.339	6.628	44.982	7.162	47.629	7.750	50.278	8.389	52.927	9.080	55.574	9.820	58.215	10.609	40	35 (H) 30 (P)*
35	24.310	4.074	26.893	4.304	29.494	4.598	32.110	4.957	34.739	5.379	37.376	5.863	40.021	6.409	42.669	7.015	45.318	7.681	47.966	8.403	50.609	9.182	53.244	10.014	55.870	10.900	35	
33	23.363	3.876	25.950	4.119	28.555	4.431	31.173	4.811	33.808	5.258	36.449	5.771	39.095	6.348	41.745	6.998	44.393	7.690	47.038	8.452	49.675	9.271	52.303	10.147	54.918	11.077	33	
30	21.942	3.583	24.536	3.851	27.149	4.194	29.776	4.610	32.414	5.100	35.060	5.661	37.709	6.292	40.357	6.991	43.002	7.755	45.638	8.584	48.263	9.473	50.872	10.422	53.464	11.426	30	30 (H)**
25	19.580	3.112	22.187	3.433	24.813	3.842	27.452	4.339	30.099	4.921	32.748	5.586	35.394	6.331	38.032	7.153	40.655	8.049	43.260	9.014	45.840	10.045	48.392	11.139	50.910	12.289	25	
23	18.638	2.932	21.251	3.280	23.883	3.724	26.526	4.262	29.175	4.891	31.823	5.608	34.463	6.411	37.089	7.294	39.695	8.253	42.276	9.284	44.825	10.383	47.336	11.543			23	25 (P)*
20	17.227	2.673	19.851	3.074	22.491	3.581	25.139	4.195	27.787	4.910	30.425	5.723	33.047	6.627	35.643	7.617	38.206	8.688	40.728	9.831							20	25 (H)**
15	14.888	2.305	17.390	2.831	20.179	3.495	22.819	4.292	25.436	5.211	28.017	6.242	30.546	7.373													15	20 (P)*
14	14.423	2.245	17.068	2.806	19.715	3.514	22.348	4.360	24.950	5.332	27.504	6.419															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 51 Degrees

$\Delta = 51°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed Limits
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1232.489	269.939	1234.995	269.954	1237.502	269.970	1240.009	269.987	1242.517	270.005	1245.025	270.024	1247.533	270.044	1250.042	270.065	1252.551	270.087	1255.061	270.109	1257.571	270.133	1260.081	270.157	1262.592	270.183	2500	
2200	1089.403	237.376	1091.910	237.394	1094.418	237.412	1096.926	237.432	1099.435	237.452	1101.944	237.474	1104.453	237.496	1106.964	237.520	1109.474	237.544	1111.985	237.570	1114.496	237.597	1117.008	237.625	1119.520	237.653	2200	
2000	994.013	216.004	996.521	216.023	999.030	216.043	1001.539	216.065	1004.049	216.087	1006.559	216.111	1009.069	216.136	1011.580	216.162	1014.092	216.189	1016.604	216.217	1019.116	216 247	1021.629	216.277	1024.142	216.309	2000	
1800	898.625	194.433	901.134	194.456	903.644	194.479	906.154	194.502	908.665	194.527	911.176	194.553	913.687	194.581	916.199	194.610	918.712	194.640	921.225	194.671	923.739	194.704	926.253	194.738	928.768	194.773	1800	
1500	755.547	162.089	758.057	162.115	760.569	162.142	763.081	162.170	765.593	162.200	768.106	162.232	770.621	162.265	773.135	162.300	775.650	162.335	778.166	162.373	780.683	162.413	783.199	162.453	785.717	162.496	1500	
1200	612.475	129.760	614.988	129.792	617.502	129.825	620.017	129.861	622 533	129.899	625.049	129.938	627.567	129.979	630.085	130.023	632.604	130.068	635.123	130.115	637.644	130.164	640.165	130.215	642.687	130.268	1200	
1000	517.100	108.224	519.616	108.262	522.133	108.302	524.651	108.345	527.170	108.390	529.689	108.437	532.210	108.487	534.732	108.539	537.254	108.593	539.778	108.649	542.302	108.708	544.827	108.770	547.353	108.833	1000	
900	469.416	97.464	471.934	97.506	474.453	97.551	476.972	97.598	479.493	97.648	482.015	97.701	484 538	97.756	487.062	97.813	489 587	97.874	492.113	97.937	494.639	98.002	497.167	98.070	499.696	98.141	900	
800	421.756	86.712	424.256	86.760	426.777	86.810	429.299	86.863	431.822	86.920	434.346	86.979	436.872	87.041	439.399	87.106	441.927	87.173	444.456	87.244	446.985	87.317	449.517	87.394	452.049	87.473	800	
700	374.060	75.972	376.583	76.026	379.106	76.084	381.631	76.145	384.158	76.209	386.686	76.277	389.215	76.347	391.745	76.422	394.277	76.499	396.809	76.580	399.344	76.664	401.879	76.751	404.416	76.842	700	
600	326.391	65.249	328.917	65.313	331.445	65.380	333.974	65.451	336.505	65.526	339.037	65.605	341.570	65.688	344.105	65.774	346.642	65.865	349.180	65.959	351.719	66.057	354.260	66.159	356.802	66.264	600	
500	278.733	54.555	281.264	54.631	283.797	54.712	286.332	54.797	288.868	54.887	291.406	54.982	293.946	55.081	296.488	55.185	299.031	55.293	301.576	55.406	304.122	55.523	306.671	55.646	309.220	55.772	500	
400	231.095	43.910	233.633	44.005	236.173	44.105	238.716	44.212	241.261	44.325	243.807	44.443	246.356	44 567	248.907	44.697	251.460	44.832	254.015	44.973	256 572	45.120	259.131	45.272	261.691	45.431	400	
360	212.048	39.675	214.590	39.780	217.135	39.892	219.681	40.011	222.231	40.135	224.782	40.267	227.336	40.405	229.892	40.549	232.450	40.699	235.010	40.855	237.572	41.019	240.137	41.188	242.703	41.364	360	100 (P)*
300	207.287	38.619	209.830	38.727	212.376	38.843	214.924	38.965	217.475	39.093	220.028	39.228	222.583	39.369	225.140	39.518	227.699	39.672	230.261	39.833	232.825	40.001	235.391	40.176	237.959	40.356	350	
300	183.493	33.363	186.042	33 490	188.595	33.624	191.150	33.766	193.708	33.916	196.269	34.073	198.832	34.238	201.397	34.411	203.965	34.591	206.536	34.779	209.109	34.975	211.684	35.178	214.262	35.389	300	
250	159.718	28.163	162.277	28.315	164.838	28.476	167.403	28.646	169.971	28 826	172.542	29.015	175.115	29.213	177.692	29.419	180.271	29.636	182.853	29.861	185.438	30.095	188.025	30.339	190.615	30.591	250	
230	150.216	26.107	152.779	26.272	155.346	26.447	157.915	26.632	160.488	26.827	163.064	27.032	165.643	27.247	168.225	27.472	170.810	27.707	173.397	27.951	175.988	28.206	178.581	28.470	181.177	28.744	230	80 (P)*
200	135.977	23.061	138.548	23.251	141.123	23.452	143.701	23.665	146.283	23.889	148.868	24.124	151 456	24.371	154.047	24.629	156.642	24.899	159.239	25.180	161.840	25.472	164.443	25.775	167.049	26.090	200	
170	121.759	20.082	124.340	20.305	126.925	20.542	129.515	20.792	132.107	21.055	134.704	21.331	137.304	21.621	139.907	21.924	142.513	22.241	145.123	22.570	147.736	22.913	150.351	23.269	152.970	23.638	170	
155	114.661	18.630	117.249	18.875	119.840	19.134	122.436	19.408	125.036	19.696	127.639	19.999	130.246	20.316	132.856	20.648	135.469	20.995	138.086	21.356	140.705	21.731	143.328	22.120	145.953	22.524	155	65 (P)*
125	100.300	15.846	103.103	16.148	105.710	16.469	108.322	16.807	110.937	17.163	113.557	17.537	116.179	17.929	118.806	18.338	121.435	18.766	124.067	19.210	126.702	19.672	129.339	20.152	131.978	20.649	125	
100	82.750	13.230	91.370	14.107	93.994	14.505	96.622	14.926	99.253	15.368	101.889	15.833	104.527	16.319	107.167	16.826	109.810	17.356	112.455	17.906	115.101	18.478	117.749	19.071	120.397	19.684	100	
90	84.069	12.973	86.697	13.390	89.328	13.831	91.963	14.297	94.602	14.787	97.243	15.300	99.887	15.838	102.532	16.399	105.180	16.984	107.828	17.591	110.477	18.222	113.126	18.876	115.776	19.553	90	50 (P)
80	79.403	12.295	82.038	12.762	84.677	13.256	87.319	13.777	89.964	14.325	92.610	14.899	95.258	15.500	97.907	16.126	100.557	16.779	103.206	17.457	105.854	18.160	108.502	18.888	111.147	19.640	80	50 (H)**
70	74.753	11.727	77.396	12.257	80.041	12.819	82.689	13.410	85.338	14.031	87.987	14.681	90.636	15.361	93.285	16.069	95.931	16.806	98.576	17.571	101.217	18.363	103.855	19.183	106.489	20.029	70	
60	70.120	11.322	72.768	11.936	75.418	12.584	78.067	13.266	80.715	13.982	83.360	14.730	86.003	15.511	88.642	16.324	91.276	17.168	93.904	18.042	96.526	18.947	99.140	19.881	101.745	20.844	60	40 (P)*
55	67.808	11.207	70.457	11.873	73.106	12.574	75.752	13.312	78.396	14.086	81.036	14.894	83.670	15.737	86.298	16.613	88.918	17.522	91.530	18.462	94.133	19.434	96.725	20.436	99.306	21.467	55	
50	65.497	11.172	68.144	11.898	70.789	12.662	73.429	13.465	76.063	14.306	78.691	15.184	81.310	16.097	83.920	17.046	86.519	18.028	89.106	19.044	91.680	20.091	94.240	21.169	96.784	22.277	50	40 (H)**
45	63.181	11.340	65.822	12.037	68.457	12.876	71.084	13.755	73.702	14.675	76.309	15.633	78.904	16.628	81.484	17.659	84.050	18.726	86.598	19.828	89.128	20.958	91.638	22.120	94.127	23.312	45	35 (P)*
40	60.181	11.445	63.477	12.327	66.093	13.254	68.697	14.224	71.285	15.235	73.857	16.286	76.411	17.376	78.945	18.502	81.456	19.662	83.944	20.856							40	30 (H)**
35	58.484	11.436	61.082	12.821	63.662	13.852	66.223	14.928	68.761	16.046	71.274	17.205															35	
33	57.518	12.059	60.098	13.091	62.657	14.169	65.192	15.292	67.701	16.458																	33	30 (P)*
30	56.033	12.484	58.577	13.592	61.092	14.747																					30	30 (H)**
25																											25	25 (H)**
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 52 Degrees

$\Delta = 52°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	1226.832	281.510	1229.334	281.513	1231.836	281.517	1234.338	281.522	1236.841	281.528	1239.344	281.535	1241.847	281.543	1244.351	281.552	1246.855	281.562	1249.360	281.573	1251.865	281.584	1254.370	281.597	1256.876	281.610	2500	
2200	1080.513	247.729	1083.015	247.733	1085.517	247.738	1088.019	247.744	1090.522	247.751	1093.026	247.759	1095.530	247.768	1098.034	247.778	1100.539	247.789	1103.044	247.801	1105.550	247.814	1108.056	247.828	1110.562	247.843	2200	
2000	982.967	225.210	985.469	225.214	987.971	225.219	990.474	225.225	992.977	225.233	995.481	225.242	997.985	225.251	1000.490	225.262	1002.995	225.275	1005.501	225.288	1008.007	225.302	1010.514	225.318	1013.021	225.335	2000	
1800	885.420	202.690	887.923	202.694	890.425	202.700	892.928	202.707	895.432	202.716	897.936	202.725	900.441	202.736	902.946	202.748	905.452	202.762	907.965	202.777	910.466	202.793	912.973	202.810	915.481	202.829	1800	
1500	738.102	168.910	741.604	168.916	744.107	168.923	746.611	168.931	749.115	168.941	751.620	168.953	754.125	168.966	756.632	168.980	759.139	168.997	761.647	169.015	764.155	169.034	766.664	169.055	769.174	169.077	1500	
1200	592.782	135.131	595.285	135.138	597.789	135.147	600.294	135.157	602.799	135.170	605.306	135.185	607.813	135.201	610.321	135.219	612.829	135.240	615.339	135.262	617.850	135.286	620.361	135.312	622.873	135.340	1200	
1000	495.237	112.613	497.740	112.621	500.245	112.631	502.750	112.644	505.257	112.659	507.764	112.676	510.273	112.696	512.782	112.718	515.293	112.742	517.804	112.769	520.317	112.798	522.830	112.829	525.345	112.863	1000	
900	446.464	101.354	448.968	101.363	451.473	101.374	453.979	101.338	456.486	101.405	458.995	101.424	461.504	101.446	464.015	101.471	466.527	101.498	469.039	101.528	471.553	101.560	474.068	101.594	476.584	101.632	900	
800	397.691	90.095	400.196	90.105	402.702	90.118	405.208	90.134	407.717	90.153	410.226	90.174	412.737	90.199	415.249	90.227	417.762	90.257	420.276	90.290	422.791	90.326	425.308	90.366	427.826	90.408	800	
700	348.919	78.836	351.424	78.848	353.930	78.863	356.438	78.881	358.948	78.903	361.458	78.927	363.971	78.956	366.484	78.987	368.999	79.022	371.515	79.060	374.033	79.101	376.552	79.146	379.072	79.194	700	100 (P)*
600	300.147	67.579	302.653	67.592	305.160	67.610	307.670	67.631	310.180	67.656	312.693	67.685	315.207	67.718	317.723	67.754	320.240	67.795	322.759	67.840	325.279	67.888	327.802	67.940	330.325	67.996	600	
500	251.375	56.322	253.882	56.338	256.391	56.359	258.902	56.385	261.415	56.415	263.930	56.449	266.447	56.489	268.966	56.533	271.486	56.582	274.009	56.635	276.533	56.693	279.060	56.755	281.588	56.823	500	
400	202.604	45.067	205.113	45.087	207.624	45.114	210.138	45.145	212.654	45.183	215.173	45.226	217.693	45.276	220.217	45.331	222.742	45.391	225.270	45.458	227.800	45.530	230.333	45.609	232.868	45.693	400	
360	183.096	40.566	185.606	40.588	188.118	40.617	190.634	40.653	193.151	40.695	195.672	40.743	198.195	40.798	200.721	40.859	203.249	40.926	205.780	41.000	208.313	41.081	210.849	41.167	213.387	41.261	360	
300	153.835	33.815	156.346	33.843	158.861	33.877	161.379	33.920	163.901	33.970	166.425	34.028	168.953	34.094	171.483	34.167	174.017	34.248	176.553	34.337	179.093	34.433	181.636	34.537	184.181	34.649	300	80 (P)*
250	129.451	28.192	131.965	28.225	134.483	28.266	137.004	28.317	139.530	28.378	142.059	28.447	144.592	28.526	147.128	28.614	149.668	28.711	152.211	28.818	154.758	28.934	157.308	29.059	159.862	29.193	250	
230	119.698	25.944	122.213	25.979	124.732	26.024	127.256	26.080	129.783	26.145	132.315	26.221	134.850	26.307	137.389	26.402	139.932	26.508	142.479	26.624	145.030	26.750	147.584	26.885	150.142	27.031	230	
200	105.069	22.573	107.586	22.613	110.108	22.665	112.635	22.729	115.166	22.804	117.702	22.891	120.243	22.990	122.787	23.100	125.336	23.221	127.889	23.354	130.447	23.499	133.008	23.655	135.573	23.823	200	
170	90.441	19.204	92.961	19.251	95.487	19.313	98.081	19.388	100.555	19.476	103.096	19.578	105.643	19.694	108.195	19.824	110.752	19.967	113.313	20.123	115.879	20.293	118.450	20.477	121.025	20.674	170	65 (P)*
155	83.127	17.521	85.650	17.573	88.178	17.640	90.712	17.722	93.252	17.820	95.797	17.932	98.348	18.059	100.904	18.200	103.466	18.357	106.032	18.529	108.604	18.715	111.180	18.916	113.761	19.132	155	
125	68.502	14.159	71.029	14.224	73.564	14.307	76.106	14.409	78.654	14.529	81.209	14.668	83.771	14.825	86.339	15.001	88.913	15.195	91.493	15.408	94.079	15.638	96.670	15.887	99.266	16.155	125	
100	56.318	11.365	58.851	11.446	61.394	11.550	63.945	11.677	66.504	11.827	69.071	12.001	71.646	12.197	74.228	12.417	76.817	12.659	79.413	12.924	82.015	13.211	84.622	13.522	87.236	13.855	100	
90	51.445	10.250	53.982	10.340	56.529	10.456	59.085	10.597	61.650	10.764	64.224	10.957	66.805	11.175	69.393	11.418	71.991	11.687	74.595	11.981	77.205	11.300	79.821	12.645	82.442	13.014	90	50 (P)*
80	46.574	9.139	49.115	9.240	51.667	9.370	54.229	9.529	56.801	9.717	59.383	9.933	61.972	10.178	64.570	10.452	67.176	10.754	69.788	11.084	72.408	11.442	75.033	11.828	77.663	12.242	80	50 (H)**
70	41.704	8.031	44.250	8.147	46.809	8.296	49.379	8.477	51.960	8.692	54.550	8.939	57.150	9.218	59.758	9.530	62.374	9.875	64.997	10.251	67.626	10.659	70.262	11.098	72.902	11.569	70	
60	36.836	6.930	39.390	7.065	41.957	7.238	44.537	7.450	47.128	7.700	49.730	7.987	52.341	8.313	54.961	8.676	57.589	9.076	60.224	9.513	62.865	9.987	65.510	10.496	68.160	11.042	60	40 (P)*
55	34.404	6.383	36.962	6.530	39.534	6.719	42.120	6.950	44.717	7.222	47.326	7.535	49.944	7.890	52.571	8.285	55.205	8.720	57.846	9.195	60.492	9.710	63.143	10.264	65.796	10.856	55	
50	31.972	5.834	34.536	6.000	37.114	6.208	39.706	6.462	42.311	6.761	44.927	7.105	47.553	7.494	50.187	7.927	52.828	8.405	55.475	8.925	58.126	9.489	60.789	10.095	63.435	10.742	50	40 (H)**
45	29.543	5.299	32.112	5.478	34.697	5.709	37.297	5.991	39.910	6.322	42.534	6.704	45.168	7.135	47.810	7.614	50.457	8.142	53.109	8.717	55.764	9.339	58.420	10.007	61.075	10.720	45	35 (P)*
40	27.115	4.765	29.691	4.967	32.285	5.226	34.894	5.542	37.516	5.914	40.149	6.342	42.791	6.825	45.440	7.361	48.093	7.951	50.748	8.594	53.404	9.247	56.057	10.000	58.707	10.822	40	35 (H) 30 (P)*
35	24.690	4.239	27.275	4.469	29.879	4.765	32.494	5.125	35.131	5.549	37.773	6.036	40.423	6.584	43.077	7.191	45.733	7.861	48.387	8.586	51.038	9.368	53.681	10.204	56.316	11.093	35	
33	23.721	4.031	26.310	4.270	28.919	4.589	31.543	4.971	34.179	5.420	36.823	5.934	39.478	6.514	42.133	7.157	44.788	7.862	47.440	8.626	50.086	9.450	52.722	10.329	55.346	11.263	33	
30	22.268	3.725	24.865	3.994	27.481	4.338	30.112	4.756	32.755	5.248	35.406	5.812	38.061	6.445	40.716	7.147	43.368	7.915	46.013	8.747	48.646	8.640	51.265	10.592	53.866	11.601	30	30 (H)**
25	19.853	3.231	21.464	3.553	23.091	3.964	24.737	4.463	26.390	5.047	28.045	5.715	29.699	6.463	31.354	7.289	33.008	8.188	34.976	9.158	43.590	10.193	46.180	11.291	48.743	12.446	25	
23	18.889	3.042	21.506	3.391	24.142	3.836	26.791	4.377	29.446	5.009	32.100	5.729	34.748	6.535	37.385	7.421	39.999	8.385	42.589	9.421	45.149	10.523	47.672	11.688			23	25 (P)*
20	17.447	2.771	20.075	3.171	22.720	3.681	25.374	4.297	28.029	5.015	30.675	5.821	33.305	6.739	35.921	7.774	38.494	8.809	41.018	9.952							20	25 (H)**
15	15.056	2.378	17.703	2.906	20.358	3.573	23.006	4.373	25.633	5.296	28.223	6.332	30.763	7.468													15	20 (P)*
14	14.580	2.314	17.231	2.877	19.885	3.588	22.526	4.437	25.138	5.414	27.703	6.505															14	20 (H)**

*P= Plain & Rolling Terrain **H= Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 52 Degrees

$\Delta = 52°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1259.382	281.624	1261.889	281.639	1264.396	281.656	1266.903	281.673	1269.411	281.691	1271.919	281.710	1274.428	281.730	1276.937	281.751	1279.446	281.771	1281.956	281.795	1284.467	281.819	1286.977	281.844	1289.488	281.869	2500	
2100	1113.070	247.860	1115.577	247.877	1118.085	247.896	1120.594	247.915	1123.103	247.936	1125.612	247.957	1128.122	247.980	1130.632	248.004	1133.142	248.028	1135.654	248.054	1138.165	248.081	1140.677	248.109	1143.189	248.138	2100	
2000	1015.529	225.353	1018.037	225.372	1020.546	225.392	1023.055	225.414	1025.565	225.436	1028.075	225.460	1030.586	225.485	1033.097	225.511	1035.609	225.538	1038.121	225.567	1040.634	225.596	1043.147	225.627	1045.661	225.659	2000	
1800	917.990	202.849	920.499	202.870	923.009	202.893	925.519	202.917	928.030	202.941	930.541	202.968	933.053	202.996	935.565	203.025	938.078	203.055	940.592	203.086	943.106	203.119	945.621	203.153	948.136	203.189	1800	
1500	771.684	169.101	774.195	169.127	776.707	169.154	779.219	169.182	781.732	169.212	784.245	169.244	786.760	169.277	789.275	169.312	791.790	169.348	794.306	169.386	796.823	169.426	799.341	169.467	801.859	169.509	1500	
1200	625.385	135.370	627.899	135.402	630.414	135.436	632.929	135.471	635.445	135.509	637.962	135.549	640.480	135.590	642.998	135.634	645.518	135.679	648.038	135.726	650.558	135.775	653.080	135.827	655.603	135.880	1200	
1000	527.860	112.899	530.377	112.937	532.894	112.978	535.412	113.021	537.931	113.066	540.451	113.113	542.972	113.163	545.495	113.215	548.018	113.270	550.542	113.326	553.067	113.385	555.592	113.447	558.119	113.510	1000	
900	479.101	101.672	481.619	101.714	484.138	101.759	486.658	101.807	489.180	101.857	491.702	101.910	494.225	101.965	496.750	102.023	499.275	102.083	501.802	102.146	504.329	102.212	506.858	102.281	509.387	102.351	900	
800	430.345	90.453	432.865	90.500	435.387	90.551	437.909	90.605	440.433	90.661	442.958	90.721	445.485	90.783	448.012	90.848	450.540	90.916	453.070	90.987	455.601	91.061	458.133	91.138	460.666	91.217	800	
700	381.594	79.245	384.117	79.300	386.642	79.358	389.167	79.419	391.694	79.484	394.223	79.552	396.752	79.623	399.283	79.697	401.816	79.775	404.349	79.856	406.885	79.940	409.420	80.028	411.958	80.119	700	
600	332.850	68.056	335.377	68.120	337.905	68.187	340.435	68.259	342.967	68.334	345.499	68.413	348.034	68.496	350.570	68.583	353.107	68.674	355.646	68.768	358.186	68.866	360.728	68.969	363.271	69.075	600	
500	284.118	56.894	286.649	56.971	289.183	57.052	291.719	57.138	294.256	57.228	296.795	57.323	299.335	57.422	301.878	57.527	304.422	57.636	306.968	57.749	309.516	57.867	312.065	57.990	314.616	58.117	500	
400	235.405	45.782	237.944	45.878	240.485	45.979	243.029	46.086	245.575	46.199	248.123	46.318	250.673	46.442	253.225	46.573	255.779	46.708	258.335	46.850	260.894	46.998	263.454	47.151	266.016	47.310	400	
360	215.928	41.361	218.471	41.467	221.017	41.579	223.565	41.698	226.116	41.823	228.668	41.956	231.223	42.094	233.781	42.238	236.340	42.389	238.903	42.547	241.466	42.711	244.032	42.881	246.600	43.057	360	100 (P)*
350	211.060	40.258	213.605	40.367	216.151	40.483	218.701	40.605	221.253	40.734	223.807	40.870	226.363	41.012	228.922	41.161	231.483	41.316	234.046	41.478	236.612	41.646	239.179	41.822	241.749	42.003	350	
300	186.729	34.769	189.280	34.896	191.834	35.031	194.391	35.174	196.950	35.324	199.512	35.482	202.077	35.648	204.644	35.822	207.214	36.003	209.786	36.191	212.361	36.388	214.938	36.592	217.518	36.804	300	
250	162.419	29.336	164.979	29.489	167.542	29.651	170.109	29.822	172.678	30.002	175.251	30.192	177.826	30.390	180.405	30.598	182.986	30.815	185.570	31.042	188.157	31.277	190.747	31.521	193.339	31.775	250	
230	152.703	27.187	155.268	27.353	157.836	27.529	160.407	27.715	162.982	27.911	165.560	28.116	168.141	28.333	170.725	28.558	173.312	28.794	175.902	29.040	178.495	29.295	181.090	29.561	183.689	29.836	230	80 (P)*
200	138.143	24.002	140.716	24.192	143.292	24.395	145.872	24.608	148.456	24.833	151.044	25.070	153.634	25.318	156.228	25.577	158.825	25.848	161.426	26.130	164.029	26.423	166.635	26.728	169.244	27.044	200	
170	123.604	20.884	126.188	21.108	128.775	21.346	131.367	21.597	133.962	21.861	136.561	22.139	139.164	22.430	141.770	22.734	144.380	23.052	146.993	23.385	149.609	23.727	152.228	24.084	154.850	24.455	170	
155	116.347	19.363	118.937	19.608	121.531	19.860	124.130	20.144	126.732	20.433	129.338	20.737	131.948	21.056	134.561	21.389	137.178	21.737	139.798	22.100	142.421	22.476	145.047	22.867	147.676	23.273	155	65 (P)*
125	101.867	16.440	104.473	16.744	107.084	17.065	109.699	17.405	112.318	17.763	114.941	18.138	117.567	18.532	120.197	18.943	122.831	19.372	125.467	19.819	128.106	20.283	130.748	20.764	133.392	21.263	125	
100	89.854	14.210	92.477	14.588	95.105	14.988	97.738	15.411	100.374	15.855	103.013	16.321	105.656	16.809	108.301	17.319	110.949	17.851	113.600	18.404	116.252	18.978	118.905	19.573	121.559	20.189	100	
90	85.069	13.408	87.700	13.826	90.336	14.269	92.976	14.737	95.619	15.229	98.265	15.745	100.914	16.284	103.565	16.848	106.218	17.435	108.873	18.045	111.528	18.679	114.183	19.335	116.839	20.015	90	50 (P)
80	80.299	12.684	82.939	13.153	85.583	13.649	88.230	14.173	90.880	14.723	93.532	15.300	96.186	15.903	98.841	16.532	101.496	17.187	104.152	17.868	106.807	18.574	109.462	19.305	112.115	20.060	80	50 (H)**
70	75.546	12.072	78.194	12.605	80.846	13.168	83.499	13.762	86.154	14.385	88.809	15.039	91.465	15.721	94.120	16.433	96.774	17.172	99.426	17.940	102.075	18.736	104.721	19.559	107.363	20.409	70	
60	70.812	11.623	73.467	13.239	76.122	12.890	78.778	13.575	81.433	14.294	84.086	15.045	86.736	15.829	89.383	16.646	92.025	17.493	94.662	18.371	97.292	19.280	99.916	20.218	102.530	21.185	60	40 (P)*
55	68.451	11.487	71.107	12.155	73.762	12.860	76.416	13.601	79.067	14.377	81.714	15.189	84.357	16.035	86.993	16.915	89.622	17.828	92.244	18.772	94.856	19.748	97.458	20.754	100.048	21.790	55	
50	66.091	11.430	68.745	12.159	71.397	12.927	74.045	13.733	76.688	14.578	79.324	15.459	81.952	16.376	84.571	17.329	87.180	18.315	89.777	19.335	92.361	20.387	94.931	21.469	97.485	22.582	50	40 (H)**
45	63.727	11.477	66.376	12.278	69.019	13.120	71.655	14.003	74.282	14.926	76.898	15.888	79.502	16.888	82.093	17.924	84.668	18.995	87.227	20.099	89.768	21.236	92.290	22.403	94.791	23.601	45	35 (P)*
40	61.350	11.662	63.985	12.548	66.610	13.479	69.223	14.452	71.821	15.468	74.404	16.524	76.968	17.618	79.513	18.748	82.035	19.914	84.535	21.113							40	30 (H)**
35	58.938	12.033	61.546	13.022	64.137	14.058	66.708	15.134	69.257	16.262	71.781	17.425															35	
33	57.955	12.249	60.546	13.265	63.115	14.368	65.661	15.496	68.181	16.667																	33	30 (P)*
30	56.445	12.663	59.000	13.776	61.527	14.936																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 53 Degrees

$\Delta = 53°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metres	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metres	
2500	1253.955	293.504	1256.456	293.508	1258.958	293.512	1261.460	293.517	1263.963	293.523	1266.466	293.530	1268.970	293.538	1271.474	293.547	1273.978	293.557	1276.483	293.568	1278.988	293.579	1281.494	293.592	1284.000	293.605	2500	
2250	1104.381	258.283	1106.883	258.289	1109.385	258.293	1111.887	258.300	1114.390	258.306	1116.894	258.314	1119.398	258.323	1121.902	258.333	1124.407	258.344	1126.912	257.356	1129.418	258.370	1131.925	258.384	1134.432	258.399	2250	
2000	1004.665	234.805	1007.167	234.810	1009.669	234.815	1012.172	234.821	1014.675	234.829	1017.179	234.838	1019.684	234.847	1022.188	234.858	1024.694	234.871	1027.200	234.884	1029.706	234.899	1032.213	234.914	1034.720	234.931	2000	
1800	904.949	211.326	907.451	211.331	909.953	211.336	912.457	211.344	914.960	211.352	917.465	211.362	919.969	211.373	922.475	211 385	924.981	211.399	927.488	211.413	929.995	211.430	932.502	211.447	935.010	211.466	1800	
1600	755.373	176.107	757.877	176.113	760.380	176.120	762.884	176.128	765.389	176.138	767.894	176.150	770.400	176.163	772.906	176.178	775.414	176.194	777.921	176.212	780.430	176.231	782.939	176.252	785.449	176.275	1600	
1400	605.801	140.889	608.304	140.896	610.808	140.903	613.313	140.915	615.819	140.928	618.325	140.942	620.832	140.959	623.341	140.977	625.849	140.998	628.359	141.020	630.870	141.044	633.381	141.070	635.894	141.098	1400	
1200	506.086	117.411	508.590	117.419	511.094	117.429	513.600	117.442	516.106	117.457	518.614	117.475	521.123	117.495	523.633	117.517	526.145	117.541	528.658	117.568	531.168	117.597	533.682	117.628	536.196	117.662	1200	
1000	456.223	105.672	458.732	105.681	461.238	105.693	463.744	105.707	466.251	105.723	468.760	105.743	471.269	105.765	473.780	105.790	476.292	105.817	478.805	105.846	481.319	105.879	483.834	105.914	486.351	105.951	1000	
900	406.378	93.933	408.875	93.943	411.381	93.956	413.888	93.972	416.396	93.991	418.906	94.013	421.417	94.038	423.929	94.065	426.443	94.096	428.957	94.130	431.473	94.166	433.990	94.205	436.508	94.248	900	100 (P)*
800	356.514	82.195	359.019	82.207	361.525	82.222	364.033	82.240	366.543	82.262	369.054	82.287	371.566	82.315	374.080	82.346	376.595	82.381	379.112	82.420	381.630	82.461	384.149	82.506	386.670	82.554	800	
700	306.656	70.458	309.163	70.471	311.670	70.489	314.180	70.510	316.691	70.535	319.203	70.564	321.718	70.597	324.234	70.634	326.751	70.675	329.271	70.719	331.792	70.768	334.314	70.820	336.839	70.876	700	
600	256.800	58.721	259.307	58.738	261.816	58.758	264.328	58.784	266.841	58.814	269.356	58.849	271.873	58.889	274.392	58.933	276.914	58.982	279.437	59.035	281.962	59.094	284.489	59.156	287.017	59.224	600	
500	206.944	46.986	209.453	47.007	211 965	47.033	214.479	47.065	216.995	47.103	219.514	47.146	222.035	47.196	224.559	47.251	227.085	47.312	229.614	47.379	232.145	47.452	234.678	47.530	237.214	47.631	500	
450	187.002	42.293	189.512	42.316	192.025	42.345	194.540	42.381	197.059	42.423	199.579	42.471	202.103	42.526	204.629	42.587	207.158	42.655	209.690	42.729	212.224	42.810	214.761	42.897	217.300	42.991	450	
400	182.017	41.120	184.527	41.143	187.040	41.173	189.556	41.210	192.075	41.253	194.596	41.303	197.120	41.359	199.648	41.423	202.177	41.492	204.710	41.569	207.245	41.652	209.782	41.741	212.323	41.838	400	80 (P)*
350	157.090	35.255	159.602	35.282	162.117	35.317	164.635	35.360	167.157	35.410	169.682	35.468	172.210	35.534	174.742	35.608	177.276	35.689	179.814	35.779	182.354	35.875	184.898	35.980	187.444	36.093	350	
300	132.164	29.392	134.678	29.425	137.196	29.466	139.718	29.518	142.244	29.578	144.774	29.648	147.307	29.727	149.845	29.815	152.385	29.913	154.930	30.020	157.478	30.136	160.029	30.262	162.584	30.397	300	
250	122.194	27.044	124.709	27.083	127.229	27.129	129.753	27.184	132.281	27.250	134.813	27.326	137.349	27.412	139.890	27.508	142.434	27.614	144.982	27.730	147.533	27.857	150.089	27.993	152.648	28.140	250	
230	107.239	23.532	109.757	23.573	112.280	23.626	114.807	23.690	117.339	23.765	119.876	23.852	122.417	23.951	124.963	24.062	127.513	24.184	130.067	24.317	132.626	24.463	135.189	24.619	137.756	24.788	230	
200	92.286	20.020	94.807	20.068	97.333	20.129	99.865	20.204	102.402	20.293	104.945	20.396	107.493	20.512	110.046	20.642	112.604	20.786	115.167	20.943	117.733	21.114	120.307	21.298	122.884	21.496	200	65 (P)*
180	84.810	18.263	87.332	18.317	89.861	18.385	92.396	18.467	94.937	18.565	97.483	18.677	100.035	18.805	102.593	18.947	105.156	19.105	107.725	19.277	110.298	19.464	112.878	19.666	115.459	19.883	180	
150	69.859	14.729	72.387	14.824	74.922	14.908	77.465	15.010	80.015	15.131	82.571	15.270	85.135	15.428	87.704	15.605	90.280	15.800	92.862	16.013	95.450	16.245	98.043	19.495	100.642	16.763	150	
125	57.403	11.845	59.938	11.926	62.481	12.031	65.034	12.159	67.594	12.310	70.163	12.484	72.740	12.681	75.324	12.901	77.916	13.145	80.514	13.411	83.118	13.700	85.729	14.011	88.346	14.346	125	
100	45.923	9.453	48.460	9.532	51.000	9.635	53.544	9.755	56.092	9.915	58.644	10.104	61.200	10.321	63.760	10.567	66.324	10.842	68.891	11.145	71.462	11.477	74.037	11.836	76.615	12.224	100	50 (P)*
90	41.283	8.468	43.812	8.484	46.344	8.513	48.879	8.555	51.418	8.610	53.960	8.678	56.506	8.760	59.055	8.855	61.608	8.964	64.164	9.087	66.723	9.224	69.286	9.375	71.851	9.540	90	
80	36.635	7.519	39.169	7.534	41.705	7.558	44.244	7.592	46.786	7.637	49.331	7.693	51.879	7.761	54.430	7.841	56.984	7.934	59.541	8.040	62.101	8.159	64.664	8.292	67.230	8.438	80	
70	31.980	6.567	34.520	6.582	37.063	6.605	39.610	6.637	42.161	6.680	44.715	6.734	47.273	6.801	49.834	6.881	52.398	6.974	54.966	7.081	57.537	7.203	60.112	7.340	62.691	7.492	70	
60	27.322	5.611	29.866	5.628	32.413	5.653	34.964	5.687	37.519	5.732	40.078	5.788	42.641	5.858	45.208	5.940	47.779	6.037	50.355	6.149	52.935	6.277	55.520	6.423	58.109	6.587	60	40 (P)*
50	22.660	4.652	25.210	4.671	27.764	4.699	30.322	4.737	32.885	4.787	35.453	4.850	38.027	4.927	40.607	5.020	43.193	5.130	45.785	5.259	48.384	5.410	50.990	5.585	53.603	5.785	50	
45	20.328	4.172	22.882	4.192	25.441	4.222	28.005	4.264	30.575	4.319	33.151	4.389	35.734	4.476	38.324	4.582	40.922	4.710	43.529	4.863	46.146	5.044	48.773	5.256	51.411	5.500	45	40 (H)**
40	17.991	3.691	20.550	3.712	23.115	3.744	25.686	3.790	28.265	3.853	30.852	3.935	33.448	4.040	36.054	4.173	38.671	4.338	41.300	4.541	43.941	4.787	46.594	5.080	49.259	5.423	40	35 (P)*
35	15.650	3.209	18.218	3.228	20.792	3.258	23.373	3.301	25.963	3.361	28.563	3.444	31.174	3.556	33.798	3.705	36.437	3.900	39.093	4.152	41.767	4.469	44.461	4.862	47.178	5.346	35	30 (H)**
30	13.305	2.726	15.884	2.743	18.469	2.772	21.061	2.815	23.663	2.877	26.276	2.962	28.904	3.076	31.548	3.232	34.213	3.439	36.904	3.708	39.627	4.055	42.387	4.500	45.190	5.071	30	25 (P)*
25	10.955	2.244	13.545	2.259	16.142	2.286	18.746	2.329	21.361	2.393	23.990	2.482	26.638	2.601	29.310	2.765	32.013	2.987	34.753	3.276	37.538	3.646	40.376	4.114	43.276	4.707	25	20 (H)**
20	8.600	1.762	11.201	1.775	13.805	1.800	16.417	1.843	19.040	1.909	21.680	2.003	24.343	2.132	27.036	2.309	29.771	2.550	32.559	2.863	35.413	3.260	38.347	3.752	41.377	4.343	20	
15	6.240	1.279	8.852	1.290	11.460	1.314	14.076	1.357	16.705	1.424	19.353	1.523	22.030	1.658	24.750	1.844	27.530	2.095	30.389	2.423	33.350	2.838	36.437	3.358	39.678	3.979	15	15 (H)**
14	5.679	1.164	8.292	1.175	10.900	1.199	13.516	1.242	16.145	1.309	18.793	1.408	21.470	1.543	24.190	1.729	26.971	1.980	29.829	2.313	32.790	2.728	35.877	3.248	39.118	3.869	14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 53 Degrees

$\Delta = 53°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed Limits
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1286.506	293.620	1289.013	293.635	1291.520	293.651	1294.028	293.668	1296.535	293.687	1299.044	293.706	1301.553	293.726	1304.062	293.747	1306.572	293.769	1309.082	293.792	1311.592	293.815	1314.103	293.840	1316.614	293.865	2500	
2200	1136.938	258.416	1139.446	258.433	1141.954	258.452	1144.463	258.471	1146.972	258.492	1149.482	258.514	1151.992	258.537	1154.502	258.560	1157.013	258.585	1159.524	258.611	1162.036	258.638	1164.549	258.666	1167.061	258.695	2200	
2000	1037.229	234.949	1039.737	234.969	1042.246	234.989	1044.755	235.010	1047.265	235.033	1049.776	235.057	1052.287	235.082	1054.798	235.108	1057.310	235.135	1059.823	235.164	1062.336	235.194	1064.849	235.225	1067.363	235.256	2000	
1800	937.519	211.486	940.019	211.507	942.539	211.530	945.049	211.554	947.560	211.579	950.072	211.605	952.584	211.633	955.097	211.662	957.610	211.693	960.124	211.724	962.638	211.757	965.153	211.795	967.669	211.827	1800	
1500	787.959	176.299	790.471	176.324	792.983	176.352	795.495	176.380	798.008	176.411	800.522	176.442	803.037	176.476	805.552	176.511	808.068	176.547	810.585	176.585	813.102	176.625	815.620	176.666	818.138	176.708	1500	
1200	638.407	141.128	640.921	141.161	643.436	141.195	645.951	141.230	648.468	141.268	650.985	141.306	653.503	141.350	656.022	141.393	658.542	141.439	661.062	141.486	663.584	141.536	666.106	141.587	668.629	141.641	1200	
1000	538.712	117.698	541.229	117.737	543.747	117.777	546.265	117.820	548.785	117.866	551.305	117.914	553.827	117.964	556.350	118.016	558.873	118.071	561.398	118.127	563.923	118.187	566.449	118.249	568.977	118.313	1000	
900	488.868	105.991	491.387	106.034	493.906	106.079	496.427	106.127	498.949	106.177	501.472	106.230	503.996	106.286	506.521	106.344	509.047	106.405	511.574	106.468	514.102	106.534	516.631	106.603	519.161	106.674	900	
800	439.028	94.292	441.549	94.341	444.071	94.392	446.594	94.445	449.118	94.502	451.644	94.562	454.171	94.624	456.698	94.690	459.228	94.758	461.758	94.829	464.289	94.903	466.822	94.980	469.456	95.061	800	
700	389.192	82.606	391.716	82.661	394.241	82.719	396.767	82.780	399.295	82.845	401.824	82.913	404.354	82.985	406.886	83.060	409.419	83.138	411.954	83.219	414.490	83.304	417.027	83.392	419.565	83.483	700	
600	339.365	70.937	341.292	71.001	344.421	71.069	346.951	71.140	349.483	71.216	352.017	71.295	354.552	71.379	357.089	71.466	359.627	71.557	362.167	71.652	364.708	71.751	367.251	71.854	369.795	71.960	600	
500	289.548	59.296	292.080	59.373	294.615	59.454	297.151	59.540	299.689	59.631	302.229	59.726	304.771	59.826	307.314	59.931	309.860	60.040	312.407	60.154	314.956	60.273	317.506	60.396	320.059	60.524	500	
400	239.751	47.705	242.292	47.801	244.834	47.902	247.379	48.010	249.925	48.123	252.475	48.242	255.026	48.367	257.579	48.498	260.135	48.635	262.692	48.777	265.252	48.925	267.814	49.079	270.378	49.239	400	
360	219.842	43.098	222.386	43.198	224.933	43.311	227.482	43.431	230.034	43.556	232.588	43.689	235.144	43.828	237.703	43.973	240.264	44.125	242.827	44.282	245.393	44.447	247.961	44.618	250.531	44.795	360	100 (P)*
350	214.866	41.941	217.411	42.051	219.959	42.167	222.510	42.290	225.063	42.419	227.618	42.556	230.176	42.698	232.736	42.848	235.298	43.003	237.863	43.166	240.431	43.335	243.000	43.511	245.572	43.694	350	
300	189.994	36.213	192.546	36.340	195.101	36.476	197.659	36.620	200.220	36.771	202.783	36.929	205.350	37.095	207.919	37.270	210.490	37.452	213.064	37.641	215.641	37.838	218.220	38.043	220.802	38.256	300	
250	165.143	30.541	167.704	30.694	170.269	30.857	172.837	31.029	175.409	31.210	177.983	31.400	180.560	31.600	183.141	31.808	185.724	32.026	188.311	32.253	190.900	32.490	193.492	32.735	196.087	32.990	250	
230	155.211	28.296	157.777	28.463	160.347	28.639	162.920	28.826	165.497	29.023	168.077	29.230	170.660	29.447	173.246	29.673	175.835	29.910	178.428	30.157	181.023	30.413	183.621	30.680	186.223	30.957	230	80 (P)*
200	140.327	24.968	142.902	25.159	145.480	25.362	148.063	25.577	150.649	25.803	153.238	26.040	155.831	26.289	158.428	26.550	161.028	26.821	163.631	27.105	166.237	27.399	168.846	27.705	171.458	28.023	200	
170	123.466	21.707	126.051	21.932	130.641	22.171	133.235	22.423	135.833	22.688	138.435	22.967	141.041	23.260	143.650	23.565	146.262	23.884	148.878	24.217	151.498	24.562	154.120	24.921	156.746	25.294	170	
155	113.047	20.115	120.640	20.361	123.236	20.623	125.837	20.899	128.442	21.190	131.052	21.495	133.665	21.815	136.281	22.150	138.901	22.499	141.525	22.863	144.152	23.242	146.782	23.634	149.415	24.042	155	65 (P)*
125	103.246	17.050	105.855	17.355	108.469	17.678	111.087	18.019	113.710	18.378	116.336	18.756	118.967	19.151	121.601	19.564	124.238	19.995	126.879	20.443	129.523	20.909	132.169	21.393	134.818	21.894	125	
100	80.968	14.703	93.595	15.082	96.227	15.484	98.863	15.908	101.503	16.355	104.147	16.823	106.795	17.313	109.445	17.825	112.099	18.359	114.754	18.914	117.412	19.491	120.071	20.089	122.731	20.707	100	
90	86.077	13.854	88.713	14.274	91.353	14.719	93.997	15.189	96.645	15.683	99.297	16.201	101.951	16.743	104.607	17.309	107.266	17.898	109.926	18.511	112.587	19.148	115.250	19.807	117.912	20.489	90	50 (P)
80	81.203	13.084	83.847	13.555	86.496	14.033	89.148	14.579	91.803	15.131	94.461	15.711	97.121	16.316	99.782	16.948	102.444	17.606	105.106	18.290	107.769	18.999	110.430	19.733	113.090	20.492	80	50 (H)**
70	76.347	12.425	79.000	12.961	81.657	13.527	84.316	14.123	86.977	14.749	89.639	15.405	92.301	16.091	94.963	16.805	97.624	17.548	100.283	18.320	102.940	19.119	105.594	19.945	108.244	20.799	70	
60	71.511	11.932	74.171	12.551	76.833	13.205	79.495	13.892	82.157	14.614	84.818	15.369	87.476	16.156	90.131	16.976	92.781	17.827	95.426	18.709	98.066	19.622	100.698	20.564	103.322	21.535	60	40 (P)*
55	69.099	11.774	71.761	12.444	74.424	13.152	77.085	13.896	79.743	14.677	82.399	15.492	85.049	16.342	87.694	17.225	90.333	18.142	92.963	19.090	95.585	20.070	98.196	21.081	100.797	22.121	55	
50	66.690	11.695	69.351	12.427	72.011	13.198	74.667	14.008	77.317	14.856	79.962	15.741	82.599	16.663	85.228	17.619	87.846	18.610	90.453	19.634	93.047	20.690	95.628	21.778	98.193	22.895	50	40 (H)**
45	64.278	11.721	66.935	12.525	69.586	13.370	72.230	14.258	74.866	15.185	77.492	16.151	80.106	17.155	82.706	18.195	85.292	19.271	87.862	20.380	90.414	21.521	92.947	22.694	95.460	23.896	45	35 (P)*
40	61.854	21.885	64.498	12.775	67.132	13.709	69.754	14.687	72.362	15.707	74.955	16.767	77.530	17.866	80.085	19.002	82.620	20.173	85.131	21.377							40	20 (H)**
35	59.397	12.236	62.014	13.229	64.615	14.270	67.197	15.355	69.756	16.483	72.292	17.651															35	
33	58.396	12.444	60.997	13.485	63.577	14.572	66.134	15.705	68.665	16.881																	33	30 (P)*
30	56.862	12.847	59.427	13.964	61.965	15.129																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P – Plain & Rolling Terrain **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 54°$

Deflection Angle 54 Degrees

| Rc | L_s=15 metres | | L_s=20 metres | | L_s=25 metres | | L_s=30 metres | | L_s=35 metres | | L_s=40 metres | | L_s=45 metres | | L_s=50 metres | | L_s=55 metres | | L_s=60 metres | | L_s=65 metres | | L_s=70 metres | | L_s=75 metres | | Rc | Speed km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| metre | T_s | E_s | T_s | E_s | T_s | E_s | T_s | E_s | T_s | E_s | T_s | E_s | T_s | E_s | T_s | E_s | T_s | E_s | T_s | E_s | T_s | E_s | T_s | E_s | metre | |
| 2500 | 1285.816 | 305.822 | 1286.316 | 305.820 | 1288.820 | 305.832 | 1291.323 | 305.838 | 1293.826 | 305.845 | 1296.330 | 305.853 | 1298.834 | 305.862 | 1301.338 | 305.872 | 1303.843 | 305.882 | 1306.348 | 305.894 | 1308.854 | 305.906 | 1311.360 | 305.920 | 2500 | |
| 2250 | 1156.457 | 269.122 | 1170.959 | 269.125 | 1171.459 | 269.136 | 1171.959 | 269.146 | 1138.467 | 269.143 | 1140.970 | 269.151 | 1143.475 | 269.160 | 1145.979 | 269.170 | 1148.484 | 269.181 | 1150.990 | 269.193 | 1153.496 | 269.207 | 1156.002 | 279.221 | 1158.509 | 269.236 |
| 2000 | 1026.452 | 244.057 | 1029.054 | 244.061 | 1031.557 | 244.066 | 1034.060 | 244.073 | 1036.563 | 244.081 | 1039.067 | 244.089 | 1041.572 | 244.099 | 1044.076 | 244.110 | 1046.582 | 244.122 | 1049.088 | 244.136 | 1051.595 | 244.151 | 1054.102 | 244.766 | 1056.609 | 244.783 |
| 1800 | 924.048 | 220.092 | 927.150 | 220.097 | 929.652 | 220.203 | 932.156 | 220.210 | 934.659 | 220.219 | 937.164 | 220.228 | 939.669 | 220.239 | 942.174 | 220.251 | 944.680 | 220.265 | 947.187 | 220.280 | 949.695 | 220.296 | 952.202 | 220.314 | 954.711 | 220.333 |
| 1500 | 771.701 | 183.496 | 774.799 | 183.501 | 776.796 | 183.508 | 779.300 | 183.517 | 781.805 | 183.527 | 784.310 | 183.539 | 786.816 | 183.552 | 789.323 | 183.567 | 791.830 | 183.583 | 794.338 | 183.601 | 796.847 | 183.621 | 799.356 | 183.642 | 801.866 | 183.664 |
| 1200 | 618.934 | 146.800 | 621.437 | 146.807 | 623.931 | 146.815 | 626.446 | 146.826 | 628.952 | 146.839 | 631.458 | 146.854 | 633.966 | 146.870 | 636.474 | 146.889 | 538.983 | 146.909 | 641.493 | 146.931 | 644.004 | 146.956 | 646.516 | 146.982 | 649.028 | 147.010 |
| 1000 | 517.030 | 122.736 | 519.533 | 122.744 | 522.038 | 122.755 | 524.544 | 122.768 | 527.051 | 122.783 | 529.559 | 122.401 | 532.068 | 122.421 | 534.578 | 122.443 | 537.088 | 122.467 | 539.600 | 122.494 | 542.114 | 122.523 | 544.627 | 122.555 | 547.143 | 122.589 |
| 900 | 466.582 | 110.165 | 468.582 | 110.114 | 471.087 | 110.126 | 473.594 | 110.140 | 476.101 | 110.157 | 478.610 | 110.176 | 481.120 | 110.198 | 483.631 | 110.223 | 486.143 | 110.250 | 488.656 | 110.281 | 491.171 | 110.313 | 493.686 | 110.348 | 496.203 | 110.386 |
| 800 | 417.126 | 97.852 | 417.631 | 97.864 | 420.136 | 97.877 | 422.644 | 97.913 | 425.152 | 97.932 | 427.662 | 97.954 | 430.173 | 97.979 | 432.686 | 98.007 | 435.199 | 98.037 | 437.714 | 98.071 | 440.230 | 98.108 | 442.748 | 98.147 | 445.267 | 98.189 |
| 700 | 364.153 | 85.443 | 366.660 | 85.455 | 369.166 | 85.470 | 371.695 | 85.488 | 374.204 | 85.710 | 376.716 | 85.735 | 379.228 | 85.763 | 381.742 | 85.795 | 384.258 | 85.830 | 386.775 | 85.869 | 389.293 | 85.910 | 391.813 | 85.956 | 394.334 | 86.004 |
| 600 | 311.323 | 73.033 | 313.829 | 73.037 | 316.337 | 73.044 | 320.747 | 73.496 | 323.258 | 73.491 | 325.771 | 73.520 | 328.286 | 73.553 | 330.802 | 73.590 | 333.320 | 73.631 | 335.840 | 73.676 | 338.361 | 73.725 | 340.885 | 73.778 | 343.409 | 73.834 |
| 500 | 260.272 | 61.184 | 264.779 | 61.200 | 267.289 | 61.221 | 269.800 | 61.247 | 272.314 | 61.278 | 274.829 | 61.313 | 277.347 | 61.352 | 279.866 | 61.397 | 282.388 | 61.446 | 284.912 | 61.500 | 287.437 | 61.558 | 289.965 | 61.621 | 292.494 | 61.689 |
| 400 | 211.322 | 48.957 | 213.831 | 48.977 | 216.343 | 49.003 | 218.857 | 49.036 | 221.373 | 49.074 | 223.893 | 49.117 | 226.415 | 49.167 | 228.939 | 49.223 | 231.466 | 49.284 | 233.995 | 49.351 | 236.527 | 49.424 | 239.061 | 49.503 | 241.597 | 49.588 |
| 360 | 190.942 | 44.467 | 193.452 | 44.089 | 195.965 | 44.118 | 198.481 | 44.154 | 201.000 | 44.197 | 203.521 | 44.245 | 206.045 | 44.300 | 208.572 | 44.362 | 211.102 | 44.430 | 213.634 | 44.505 | 216.169 | 44.586 | 218.707 | 44.674 | 221.247 | 44.768 |
| 320 | 169.847 | 42.844 | 188.358 | 42.867 | 190.871 | 42.898 | 193.387 | 42.934 | 195.907 | 42.978 | 198.429 | 43.028 | 200.953 | 43.084 | 203.481 | 43.148 | 206.012 | 43.218 | 208.545 | 43.295 | 211.081 | 43.378 | 213.619 | 43.469 | 216.161 | 43.565 |
| 300 | 160.373 | 36.733 | 162.885 | 36.760 | 165.401 | 36.795 | 167.920 | 36.838 | 170.442 | 36.889 | 172.968 | 36.947 | 175.497 | 37.013 | 178.029 | 37.087 | 180.564 | 37.169 | 183.102 | 37.259 | 185.644 | 37.356 | 188.188 | 37.461 | 190.736 | 37.574 |
| 250 | 134.900 | 30.624 | 137.413 | 30.656 | 139.933 | 30.698 | 142.456 | 30.750 | 144.982 | 30.811 | 147.513 | 30.881 | 150.047 | 30.960 | 152.585 | 31.049 | 155.127 | 31.147 | 157.672 | 31.255 | 160.222 | 31.371 | 162.774 | 31.497 | 165.330 | 31.633 |
| 230 | 124.711 | 28.181 | 127.227 | 28.216 | 129.747 | 28.262 | 132.272 | 28.318 | 134.800 | 28.384 | 137.333 | 28.460 | 139.870 | 28.547 | 142.412 | 28.643 | 144.957 | 28.750 | 147.506 | 28.866 | 150.059 | 28.993 | 152.616 | 29.130 | 155.176 | 29.278 |
| 200 | 109.429 | 24.518 | 111.947 | 24.559 | 114.470 | 24.611 | 116.998 | 24.676 | 119.531 | 24.752 | 122.068 | 24.839 | 124.610 | 24.938 | 127.157 | 25.049 | 129.709 | 25.172 | 132.264 | 25.306 | 134.824 | 25.452 | 137.389 | 25.610 | 139.957 | 25.779 |
| 170 | 94.147 | 20.857 | 96.668 | 20.905 | 99.195 | 20.967 | 101.725 | 21.043 | 104.266 | 21.132 | 106.810 | 21.235 | 109.359 | 21.352 | 111.913 | 21.483 | 114.473 | 21.627 | 117.037 | 21.785 | 119.607 | 21.956 | 122.181 | 22.141 | 124.760 | 22.340 |
| 155 | 86.307 | 19.028 | 89.030 | 19.081 | 91.559 | 19.149 | 94.095 | 19.232 | 96.637 | 19.330 | 99.184 | 19.443 | 101.738 | 19.571 | 104.297 | 19.714 | 106.861 | 19.872 | 109.431 | 20.045 | 112.007 | 20.233 | 114.587 | 20.436 | 117.172 | 20.654 |
| 125 | 71.228 | 15.375 | 73.756 | 15.440 | 76.293 | 15.524 | 78.836 | 15.627 | 81.387 | 15.749 | 83.945 | 15.889 | 86.519 | 16.047 | 89.081 | 16.225 | 91.659 | 16.420 | 94.243 | 16.635 | 96.833 | 16.868 | 99.429 | 17.119 | 102.031 | 17.388 |
| 100 | 56.399 | 12.118 | 61.034 | 12.420 | 63.579 | 12.525 | 66.132 | 12.653 | 68.694 | 12.805 | 71.265 | 12.980 | 73.844 | 13.178 | 76.430 | 13.399 | 79.024 | 13.643 | 81.625 | 13.911 | 84.232 | 14.201 | 86.846 | 14.514 | 89.466 | 14.850 |
| 90 | 53.409 | 11.126 | 55.947 | 11.217 | 58.497 | 11.334 | 61.055 | 11.477 | 63.624 | 11.645 | 66.201 | 11.839 | 68.787 | 12.059 | 71.381 | 12.305 | 73.983 | 12.576 | 76.592 | 12.872 | 79.208 | 13.194 | 81.831 | 13.542 | 84.460 | 13.914 |
| 80 | 48.320 | 9.918 | 50.863 | 10.020 | 53.418 | 10.151 | 55.983 | 10.311 | 58.559 | 10.501 | 61.144 | 10.719 | 63.739 | 10.966 | 66.342 | 11.242 | 68.953 | 11.547 | 71.573 | 11.880 | 74.199 | 12.241 | 76.831 | 12.631 | 79.470 | 13.048 |
| 70 | 43.232 | 8.713 | 45.781 | 8.830 | 48.343 | 8.980 | 50.916 | 9.163 | 53.501 | 9.379 | 56.096 | 9.629 | 58.701 | 9.911 | 61.316 | 10.225 | 63.938 | 10.573 | 66.569 | 10.952 | 69.206 | 11.364 | 71.850 | 11.807 | 74.499 | 12.282 |
| 60 | 38.147 | 7.515 | 40.704 | 7.651 | 43.274 | 7.826 | 45.858 | 8.039 | 48.454 | 8.291 | 51.062 | 8.582 | 53.679 | 8.910 | 56.307 | 9.276 | 58.942 | 9.680 | 61.586 | 10.120 | 64.236 | 10.598 | 66.891 | 11.113 | 69.551 | 11.663 |
| 55 | 35.606 | 6.919 | 38.167 | 7.068 | 40.743 | 7.258 | 43.333 | 7.491 | 45.936 | 7.766 | 48.551 | 8.082 | 51.176 | 8.439 | 53.811 | 8.838 | 56.454 | 9.277 | 59.104 | 9.756 | 61.760 | 10.276 | 64.421 | 10.834 | 67.086 | 11.432 |
| 50 | 33.066 | 6.327 | 35.633 | 6.490 | 38.215 | 6.700 | 40.812 | 6.955 | 43.423 | 7.257 | 46.046 | 7.604 | 48.679 | 7.997 | 51.321 | 8.434 | 53.972 | 8.915 | 56.629 | 9.440 | 59.291 | 10.009 | 61.957 | 10.620 | 64.625 | 11.273 |
| 45 | 30.524 | 5.738 | 33.101 | 5.920 | 35.691 | 6.152 | 38.296 | 6.436 | 40.916 | 6.771 | 43.547 | 7.156 | 46.189 | 7.590 | 48.840 | 8.074 | 51.498 | 8.607 | 54.161 | 9.187 | 56.828 | 9.814 | 59.497 | 10.488 | 62.166 | 11.207 |
| 40 | 27.992 | 5.156 | 30.572 | 5.360 | 33.171 | 5.621 | 35.786 | 5.940 | 38.416 | 6.315 | 41.057 | 6.747 | 43.708 | 7.234 | 46.368 | 7.775 | 49.037 | 8.370 | 51.720 | 9.018 | 54.369 | 9.718 | 57.037 | 10.467 | 59.722 | 11.267 |
| 35 | 25.458 | 4.582 | 28.048 | 4.814 | 30.658 | 5.113 | 33.284 | 5.476 | 35.925 | 5.904 | 38.577 | 6.394 | 41.237 | 6.947 | 43.903 | 7.561 | 46.572 | 8.235 | 49.241 | 8.967 | 51.917 | 9.756 | 54.597 | 10.599 | 57.219 | 11.496 |
| 33 | 24.446 | 4.355 | 27.040 | 4.603 | 29.655 | 4.918 | 32.286 | 5.303 | 34.932 | 5.755 | 37.588 | 6.275 | 40.251 | 6.859 | 42.919 | 7.508 | 45.588 | 8.219 | 48.255 | 8.990 | 50.917 | 9.821 | 53.571 | 10.708 | 56.213 | 11.650 |
| 30 | 22.929 | 4.020 | 25.531 | 4.291 | 28.153 | 4.638 | 30.793 | 5.060 | 33.446 | 5.556 | 36.108 | 6.125 | 38.775 | 6.764 | 41.444 | 7.471 | 44.111 | 8.246 | 46.772 | 9.085 | 49.423 | 9.986 | 52.060 | 10.947 | 54.681 | 11.965 |
| 25 | 20.406 | 3.478 | 23.023 | 3.802 | 25.661 | 4.217 | 28.314 | 4.720 | 30.978 | 5.310 | 33.647 | 5.984 | 36.315 | 6.738 | 38.976 | 7.571 | 41.626 | 8.478 | 44.259 | 9.456 | 46.870 | 10.501 | 49.454 | 11.608 | 52.006 | 12.774 |
| 23 | 19.399 | 3.269 | 22.023 | 3.621 | 24.668 | 4.071 | 27.327 | 4.616 | 29.994 | 5.253 | 32.663 | 5.980 | 35.327 | 6.793 | 37.979 | 7.687 | 40.613 | 8.659 | 43.224 | 9.704 | 45.805 | 10.816 | 48.351 | 11.991 | | |
| 20 | 17.893 | 2.970 | 20.529 | 3.373 | 23.184 | 3.888 | 25.850 | 4.509 | 28.519 | 5.234 | 31.181 | 6.027 | 33.829 | 6.973 | 36.454 | 7.976 | 39.048 | 9.061 | 41.604 | 10.219 | | | | | | |
| 15 | 15.396 | 2.530 | 18.054 | 3.062 | 20.722 | 3.736 | 23.386 | 4.543 | 26.030 | 5.474 | 28.641 | 6.518 | 31.203 | 7.664 | | | | | | | | | | | | |
| 14 | 14.900 | 2.456 | 17.561 | 3.025 | 20.230 | 3.742 | 22.888 | 4.399 | 25.518 | 5.483 | 28.104 | 6.684 | | | | | | | | | | | | | | |

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 54 Degrees

$\Delta = 54°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1313.867	305.935	1316.373	305.950	1318.881	305.966	1321.389	305.984	1323.897	306.002	1326.406	306.021	1328.914	306.041	1331.424	306.062	1333.934	306.084	1336.444	306.107	1338.955	306.131	1341.466	306.156	1343.977	306.181	2500	
2200	1161.016	269.253	1163.524	269.271	1166.032	269.289	1168.541	269.309	1171.051	269.330	1173.560	269.351	1176.071	269.374	1178.581	269.398	1181.093	269.423	1183.604	269.449	1186.116	269.476	1188.629	269.504	1191.142	269.533	2200	
2000	1059.117	244.802	1061.626	244.821	1064.135	244.841	1066.645	244.863	1069.155	244.885	1071.666	244.910	1074.177	244.934	1076.689	244.961	1079.201	244.989	1081.714	245.017	1084.227	245.047	1086.741	245.078	1089.255	245.110	2000	
1800	957.220	220.353	959.729	220.374	962.240	220.397	964.750	220.421	967.262	220.446	969.773	220.473	972.286	220.501	974.799	220.530	977.312	220.561	979.827	220.593	982.341	220.625	984.857	220.660	987.373	220.696	1800	
1600	804.377	183.688	806.888	183.714	809.401	183.741	811.914	183.770	814.427	183.801	816.941	183.833	819.456	183.866	821.972	183.901	824.488	183.938	827.005	183.976	829.522	184.016	832.041	184.057	834.560	184.100	1600	
1400	651.542	147.041	654.056	147.073	656.571	147.107	659.087	147.143	661.604	147.181	664.122	147.221	666.640	147.263	669.160	147.306	671.680	147.352	674.201	147.400	676.723	147.449	679.245	147.501	681.769	147.555	1400	
1200	549.659	122.625	552.176	122.664	554.694	122.705	557.213	122.748	559.733	122.794	562.254	122.841	564.776	122.892	567.299	122.944	569.823	122.999	572.349	123.056	574.875	123.116	577.402	123.178	579.929	123.242	1200	
1000	498.721	110.426	501.240	110.469	503.760	110.514	506.281	110.562	508.803	110.613	511.327	110.666	513.851	110.722	516.376	110.780	518.903	110.841	521.431	110.905	523.960	110.971	526.490	111.040	529.021	111.112	1000	
900	447.786	98.235	450.308	98.283	452.830	98.334	455.354	98.388	457.879	98.445	460.405	98.505	462.933	98.568	465.461	98.634	467.991	98.702	470.522	98.774	473.054	98.848	475.587	98.926	478.122	99.009	900	
800	396.857	86.096	399.381	86.111	401.907	86.169	404.434	86.231	406.962	86.296	409.492	86.365	412.023	86.436	414.556	86.511	417.090	86.590	419.625	86.672	422.161	86.757	424.699	86.845	427.238	86.937	800	
700	345.936	73.894	348.464	73.959	350.993	74.027	353.524	74.099	356.057	74.175	358.592	74.255	361.128	74.338	363.665	74.426	366.204	74.518	368.745	74.613	371.287	74.712	373.831	74.815	376.376	74.922	700	
600	295.026	61.761	297.559	61.838	300.094	61.920	302.631	62.007	305.170	62.098	307.711	62.194	310.254	62.294	312.798	62.399	315.345	62.509	317.893	62.623	320.443	62.743	322.995	62.866	325.548	62.995	600	
500	244.136	49.678	246.677	49.775	249.221	49.877	251.766	49.985	254.314	50.099	256.865	50.219	259.417	50.344	261.972	50.476	264.529	50.613	267.088	50.756	269.649	50.904	272.212	51.059	274.778	51.219	500	
450	223.790	44.868	226.335	44.975	228.883	45.089	231.433	45.209	233.986	45.335	236.542	45.469	239.099	45.608	241.659	45.754	244.222	45.906	246.787	46.065	249.354	46.230	251.923	46.402	254.495	46.580	450	100 (P)*
400	218.704	43.649	221.251	43.779	223.800	43.896	226.352	44.019	228.906	44.149	231.463	44.286	234.022	44.429	236.584	44.580	239.148	44.736	241.714	44.899	244.283	45.069	246.854	45.246	249.428	45.429	400	
350	193.286	37.695	195.840	37.823	198.396	37.959	200.956	38.104	203.518	38.255	206.083	38.414	208.651	38.582	211.222	38.757	213.795	38.939	216.371	39.130	218.950	39.328	221.531	39.533	224.115	39.747	350	
300	167.890	31.778	170.433	31.932	173.020	32.095	175.590	32.268	178.163	32.449	180.739	32.641	183.318	32.841	185.901	33.051	188.487	33.270	191.075	33.498	193.667	33.735	196.261	33.982	198.859	34.238	300	
250	142.330	25.999	145.107	26.152	147.687	26.356	150.272	26.571	152.860	26.798	155.452	27.037	158.048	27.287	160.647	27.548	163.249	27.821	165.855	28.106	168.464	28.402	171.076	28.709	173.692	29.028	250	80 (P)*
230	127.343	22.552	129.931	22.778	132.523	23.018	135.120	23.271	137.720	23.538	140.325	23.818	142.933	24.111	145.546	24.419	148.161	24.739	150.781	25.073	153.403	25.420	156.029	25.781	158.658	26.154	230	
200	119.762	20.887	122.357	21.134	124.956	21.397	127.560	21.674	130.168	21.966	132.780	22.273	135.396	22.595	138.016	22.931	140.640	23.282	143.267	23.647	145.898	24.027	148.531	24.422	151.168	24.831	200	
175	104.638	17.676	107.249	17.983	109.866	18.307	112.488	18.650	115.114	19.011	117.744	19.389	120.379	19.786	123.017	20.201	125.658	20.634	128.304	21.084	130.952	21.552	133.603	22.038	136.227	22.542	175	65 (P)*
150	92.091	15.208	94.722	15.590	97.358	15.993	99.998	16.419	102.643	16.867	105.292	17.338	107.944	17.830	110.599	18.345	113.258	18.881	115.919	19.438	118.582	20.017	121.247	20.618	123.914	21.240	150	
90	87.094	14.311	89.734	14.734	92.379	15.181	95.027	15.652	97.680	16.148	100.337	16.669	102.996	17.213	105.658	17.782	108.323	18.374	110.989	18.990	113.656	19.629	116.325	20.291	118.994	20.976	90	50 (P)
80	82.114	13.494	84.763	13.967	87.417	14.468	90.074	14.996	92.735	15.551	95.398	16.132	98.064	16.741	100.732	17.376	103.400	18.036	106.069	18.723	108.738	19.435	111.407	20.173	114.075	20.935	80	50 (H)**
70	77.154	12.789	79.812	13.326	82.475	13.895	85.140	14.494	87.807	15.123	90.475	15.782	93.144	16.470	95.813	17.188	98.482	17.934	101.148	18.709	103.813	19.512	106.475	20.342	109.134	21.199	70	
60	72.245	12.249	74.882	12.871	77.550	13.527	80.219	14.218	82.888	14.943	85.556	15.701	88.222	16.492	90.884	17.315	93.543	18.170	96.197	19.056	98.845	19.973	101.487	20.919	104.121	21.894	60	40 (P)*
55	69.753	12.068	72.422	12.742	75.091	13.453	77.759	14.200	80.426	14.984	83.089	15.803	85.748	16.656	88.402	17.544	91.049	18.464	93.689	19.417	96.320	20.401	98.942	21.416	101.552	22.461	55	
50	67.294	11.967	69.963	12.702	72.630	13.477	75.293	14.290	77.953	15.142	80.606	16.031	83.252	16.996	85.890	17.917	88.518	18.912	91.135	19.941	93.740	21.002	96.331	22.094	98.907	23.216	50	40 (H)**
45	64.824	11.971	67.498	12.778	70.157	13.628	72.810	14.519	75.455	15.450	78.090	16.421	80.714	17.429	83.325	18.474	85.922	19.554	88.502	20.668	91.066	21.815	93.610	22.993	96.134	24.200	45	35 (P)*
40	62.362	12.114	65.015	13.007	67.658	13.946	70.290	14.928	72.908	15.953	75.511	17.018	78.097	18.121	80.663	19.262	83.209	20.438	85.732	21.647							40	30 (H)**
35	59.860	12.444	62.487	13.442	65.098	14.487	67.690	15.577	70.261	16.710	72.808	17.883															35	
33	58.841	12.645	61.452	13.690	64.043	14.782	66.611	15.920	69.154	17.101																	33	30 (P)*
30	57.281	13.036	59.857	14.158	62.407	15.324																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 55 Degrees

Δ=55°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1308.918	318.458	1311.420	318.461	1313.922	318.465	1316.424	318.470	1318.927	318.476	1321.430	318.483	1323.934	318.491	1326.438	318.500	1328.943	318.510	1331.448	318.521	1333.953	318.532	1336.459	318.545	1338.965	318.559	2500	
2200	1152.749	280.244	1155.250	280.248	1157.753	280.252	1160.255	280.258	1162.759	280.265	1165.262	280.273	1167.766	280.282	1170.271	280.292	1172.776	280.304	1175.282	280.316	1177.788	280.329	1180.294	280.344	1182.802	280.359	2200	
2000	1048.635	254.768	1051.137	254.772	1053.640	254.777	1056.143	254.784	1058.646	254.792	1061.151	254.800	1063.655	254.810	1066.160	254.821	1068.666	254.834	1071.172	254.847	1073.679	254.862	1076.186	254.878	1078.694	254.895	2000	
1800	944.522	229.297	947.025	229.297	949.527	229.303	952.031	229.310	954.535	229.318	957.039	229.328	959.544	229.339	962.050	229.352	964.556	229.365	967.063	229.380	969.571	229.397	972.078	229.414	974.587	229.433	1800	
1500	788.353	191.079	790.856	191.085	793.359	191.092	795.863	191.100	798.367	191.110	800.873	191.122	803.379	191.135	805.886	191.150	808.393	191.167	810.902	191.185	813.410	191.204	815.920	191.226	818.430	191.248	1500	
1200	632.184	152.864	634.687	152.873	637.191	152.882	639.696	152.893	642.202	152.906	644.709	152.920	647.216	152.937	649.725	152.956	652.234	152.976	654.744	152.999	657.256	153.023	659.768	153.049	662.280	153.078	1200	
1000	528.072	127.592	530.575	127.600	533.080	127.611	535.586	127.624	538.093	127.639	540.601	127.657	543.110	127.677	545.620	127.699	548.131	127.723	550.644	127.750	553.157	127.780	555.671	127.811	558.187	127.846	1000	
900	476.015	114.655	478.520	114.664	481.025	114.676	483.531	114.690	486.039	114.707	488.548	114.727	491.058	114.749	493.569	114.774	496.082	114.801	498.595	114.831	501.110	114.864	503.626	114.899	506.143	114.937	900	
800	423.959	101.918	426.464	101.928	428.970	101.942	431.478	101.958	433.986	101.977	436.496	101.999	439.008	102.024	441.520	102.052	444.034	102.083	446.549	102.116	449.066	102.153	451.584	102.193	454.103	102.235	800	100 (P)*
700	371.904	89.182	374.409	89.194	376.916	89.209	379.424	89.227	381.934	89.249	384.446	89.274	386.959	89.303	389.473	89.334	391.989	89.370	394.507	89.409	397.025	89.450	399.546	89.496	402.067	89.544	700	
600	319.848	76.446	322.354	76.460	324.862	76.478	327.372	76.499	329.884	76.525	332.397	76.554	334.912	76.587	337.429	76.623	339.947	76.666	342.468	76.711	344.990	76.760	347.513	76.812	350.038	76.869	600	
500	267.793	63.712	270.301	63.728	272.810	63.749	275.322	63.775	277.836	63.806	280.352	63.841	282.870	63.881	285.389	63.926	287.912	63.973	290.436	64.029	292.962	64.088	295.490	64.151	298.020	64.219	500	
450	215.739	50.979	218.248	51.000	220.760	51.026	223.275	51.058	225.792	51.096	228.312	51.141	230.834	51.190	233.359	51.246	235.886	51.308	238.416	51.375	240.949	51.448	243.483	51.528	246.021	51.613	450	
400	194.917	45.887	197.428	45.910	199.941	45.939	202.457	45.975	204.976	46.017	207.498	46.066	210.023	46.122	212.551	46.183	215.081	46.252	217.614	46.327	220.150	46.408	222.688	46.496	225.229	46.591	400	
350	169.712	44.614	192.223	44.637	194.737	44.667	197.253	44.704	199.773	44.748	202.295	44.798	204.821	44.855	207.349	44.919	209.880	44.990	212.414	45.066	214.951	45.150	217.490	45.241	220.032	45.338	350	
300	163.686	38.250	166.199	38.277	168.715	38.313	171.234	38.355	173.757	38.406	176.283	38.465	178.812	38.531	181.345	38.606	183.881	38.688	186.420	38.778	188.963	38.876	191.508	38.981	194.057	39.095	300	80 (P)*
250	137.661	31.888	140.176	31.920	142.695	31.963	145.218	32.014	147.745	32.075	150.276	32.146	152.811	32.226	155.350	32.315	157.893	32.414	160.439	32.521	162.990	32.639	165.544	32.765	168.101	32.901	250	
230	127.231	29.344	129.767	29.379	132.288	29.425	134.813	29.481	137.342	29.548	139.876	29.623	142.414	29.711	144.956	29.808	147.502	29.915	150.053	30.032	152.607	30.160	155.165	30.298	157.727	30.446	230	
200	111.637	26.529	114.156	25.570	116.679	25.623	119.208	25.688	121.742	25.764	124.280	25.852	126.823	25.952	129.371	26.063	131.924	26.186	134.481	26.321	137.043	26.468	139.608	26.626	142.179	26.796	200	65 (P)*
170	96.025	21.717	98.546	21.765	101.074	21.827	103.607	21.903	106.146	21.993	108.691	22.097	111.241	22.214	113.797	22.345	116.358	22.490	118.924	22.648	121.495	22.821	124.071	23.007	126.652	23.206	170	
155	88.219	19.812	90.742	19.865	93.273	19.933	95.809	20.017	98.352	20.115	100.900	20.229	103.455	20.357	106.016	20.501	108.582	20.660	111.154	20.834	113.731	21.023	116.313	21.226	118.900	21.445	155	
125	72.609	16.007	75.138	16.073	77.675	16.157	80.220	16.261	82.772	16.383	85.331	16.522	87.898	16.683	90.471	16.861	93.051	17.057	95.637	17.273	98.229	17.507	100.827	17.759	103.432	18.030	125	
100	59.604	12.844	62.140	12.926	64.686	13.032	67.240	13.161	69.804	13.313	72.377	13.489	74.957	13.688	77.546	13.910	80.142	14.155	82.745	14.424	85.356	14.715	87.972	15.030	90.596	15.367	100	50 (P)*
90	54.403	11.582	56.943	11.673	59.493	11.790	62.054	11.934	64.624	12.103	67.203	12.298	69.791	12.519	72.388	12.766	74.992	13.038	77.604	13.336	80.224	13.659	82.850	14.008	85.482	14.382	90	
80	49.204	10.323	51.749	10.425	54.304	10.537	56.871	10.718	59.449	10.909	62.037	11.128	64.634	11.376	67.240	11.653	69.854	11.959	72.476	12.294	75.106	12.657	77.743	13.048	80.386	13.468	80	50 (H)**
70	44.006	9.068	46.527	9.185	49.120	9.336	51.695	9.520	54.282	9.737	56.880	9.987	59.488	10.271	62.105	10.587	64.731	10.936	67.365	11.317	70.007	11.730	72.655	12.176	75.309	12.653	70	
65	38.811	7.819	41.369	7.956	43.942	8.131	46.527	8.346	49.126	8.599	51.736	8.891	54.357	9.220	56.988	9.588	59.628	9.993	62.276	10.436	64.930	10.916	67.591	11.433	70.256	11.986	65	40 (P)*
60	36.215	7.198	38.778	7.347	41.356	7.539	43.948	7.773	46.554	8.048	49.171	8.366	51.800	8.725	54.439	9.125	57.086	9.567	59.741	10.048	62.402	10.570	65.069	11.131	67.739	11.731	60	
55	33.620	6.580	36.188	6.744	38.773	6.955	41.373	7.212	43.986	7.515	46.612	7.864	49.249	8.258	51.896	8.697	54.552	9.180	57.214	9.708	59.881	10.279	62.553	10.893	65.228	11.549	55	40 (H)**
50	31.027	5.967	33.602	6.149	36.194	6.383	38.802	6.668	41.425	7.004	44.060	7.391	46.707	7.827	49.362	8.313	52.025	8.848	54.694	9.431	57.367	10.061	60.043	10.738	62.719	11.460	50	35 (P)*
45	28.436	5.359	31.018	5.564	33.620	5.827	36.238	6.147	38.871	6.524	41.517	6.959	44.173	7.447	46.838	7.991	49.508	8.588	52.182	9.239	54.858	9.942	57.534	10.695	60.207	11.497	45	35 (H) 30 (P)*
40	25.848	4.760	28.440	4.994	31.052	5.293	33.683	5.658	36.327	6.088	38.984	6.581	41.650	7.136	44.322	7.753	46.997	8.430	49.673	9.165	52.347	9.957	55.015	10.805	57.676	11.706	40	
35	24.813	4.523	27.410	4.771	30.028	5.089	32.663	5.475	35.313	5.930	37.974	6.451	40.644	7.039	43.318	7.690	45.994	8.404	48.669	9.179	51.339	10.014	54.001	10.905	56.653	11.851	35	
30	23.264	4.173	25.868	4.445	28.484	4.794	31.138	5.218	33.795	5.716	36.463	6.287	39.137	6.939	41.813	7.640	44.487	8.418	47.156	9.261	49.816	10.166	52.463	11.132	55.094	12.154	30	30 (H)**
25	20.686	3.606	23.306	3.932	25.948	4.348	28.607	4.854	31.277	5.446	33.952	6.123	36.627	6.881	39.297	7.718	41.956	8.629	44.598	9.611	47.219	10.661	49.814	11.773	52.377	12.944	25	
23	19.638	3.388	22.285	3.741	24.934	4.193	27.599	4.740	30.272	5.381	32.948	6.111	35.620	6.927	38.281	7.826	40.925	8.802	43.546	9.851	46.138	10.969	48.696	12.149			23	25 (P)*
20	18.119	3.073	20.759	3.479	23.419	3.995	26.091	4.620	28.767	5.347	31.437	6.174	34.094	7.024	36.729	8.102	39.334	9.492	41.902	10.955							20	25 (H)**
15	13.569	2.609	16.231	3.144	20.906	3.820	23.578	4.631	26.232	5.566	28.852	6.615	31.426	7.766													15	20 (P)*
14	15.062	2.531	17.729	3.101	20.404	3.822	23.070	4.682	25.710	5.671	28.308	6.777															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 55 Degrees

$\Delta = 55°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1341.472	318.573	1343.979	318.589	1346.486	318.605	1348.994	318.623	1351.502	318.641	1354.011	318.661	1356.521	318.681	1359.030	318.702	1361.540	318.724	1364.051	318.747	1366.562	318.771	1369.073	318.796	1371.585	318.822	2500	
2200	1185.309	280.375	1187.817	280.393	1190.326	280.412	1192.835	280.432	1195.344	280.452	1197.854	280.474	1200.365	280.497	1202.876	280.521	1205.387	280.546	1207.899	280.573	1210.411	280.600	1212.924	280.628	1215.437	280.657	2200	
2000	1081.202	254.913	1083.711	254.932	1086.220	254.951	1088.730	254.975	1091.240	254.997	1093.751	255.022	1096.263	255.047	1098.775	255.073	1101.288	255.101	1103.801	255.130	1106.314	255.159	1108.828	255.191	1111.343	255.223	2000	
1800	997.096	229.453	999.606	229.475	982.116	229.498	984.628	229.522	987.139	229.547	989.651	229.574	992.164	229.602	994.677	229.632	997.191	229.662	999.706	229.694	1002.220	229.727	1004.736	229.762	1007.253	229.798	1800	
1500	820.941	191.272	823.453	191.298	825.966	191.326	828.479	191.355	830.992	191.385	833.507	191.417	836.022	191.451	838.538	191.486	841.055	191.523	843.572	191.561	846.090	191.601	848.609	191.643	851.128	191.686	1500	
1200	664.794	153.108	667.309	153.141	669.824	153.175	672.341	153.211	674.858	153.249	677.376	153.289	679.895	153.331	682.415	153.375	684.935	153.421	687.457	153.469	689.979	153.519	692.502	153.571	695.026	153.625	1200	
1000	560.703	127.682	563.221	127.721	565.739	127.762	568.259	127.805	570.779	127.851	573.301	127.899	575.823	127.950	578.347	128.002	580.872	128.058	583.397	128.115	585.924	128.175	588.452	128.237	590.980	128.302	1000	
900	508.662	114.977	511.181	115.020	513.701	115.066	516.223	115.114	518.746	115.165	521.270	115.219	523.795	115.275	526.321	115.333	528.848	115.395	531.376	115.458	533.906	115.525	536.436	115.594	538.968	115.666	900	
800	456.623	102.281	459.145	102.329	461.668	102.381	464.192	102.435	466.718	102.492	469.245	102.552	471.773	102.615	474.302	102.681	476.832	102.750	479.364	102.823	481.897	102.897	484.431	102.975	486.967	103.056	800	
700	404.591	89.596	407.115	89.652	409.642	89.710	412.169	89.772	414.698	89.838	417.228	89.906	419.760	89.979	422.293	90.054	424.828	90.133	427.364	90.215	429.902	90.301	432.440	90.390	434.980	90.482	700	
600	352.565	76.930	355.094	76.994	357.624	77.063	360.156	77.135	362.690	77.212	365.225	77.292	367.762	77.376	370.300	77.464	372.840	77.556	375.382	77.652	377.925	77.751	380.470	77.855	383.016	77.962	600	
500	300.552	64.292	303.086	64.369	305.622	64.451	308.161	64.538	310.700	64.630	313.242	64.726	315.786	64.827	318.331	64.933	320.879	65.043	323.428	65.158	325.979	65.277	328.532	65.402	331.087	65.531	500	
400	248.560	51.704	251.102	51.801	253.647	51.903	256.194	52.012	258.742	52.126	261.294	52.246	263.848	52.373	266.404	52.505	268.962	52.642	271.522	52.786	274.085	52.935	276.650	53.091	279.217	53.252	400	
360	227.773	46.692	230.319	46.799	232.868	46.914	235.420	47.034	237.974	47.161	240.531	47.295	243.090	47.435	245.651	47.581	248.215	47.734	250.782	47.894	253.351	48.060	255.922	48.232	258.495	48.411	360	100 (P)*
350	222.577	45.442	225.125	45.552	227.675	45.670	230.228	45.794	232.784	45.925	235.342	46.062	237.902	46.206	240.465	46.357	243.031	46.514	245.599	46.678	248.170	46.849	250.743	47.026	253.318	47.210	350	
300	196.609	39.216	199.164	39.345	201.721	39.482	204.282	39.626	206.846	39.779	209.413	39.939	211.982	40.107	214.555	40.282	217.130	40.466	219.708	40.657	222.288	40.856	224.871	41.063	227.458	41.278	300	
250	170.662	33.047	173.227	33.201	175.795	33.365	178.367	33.539	180.941	33.722	183.520	33.914	186.101	34.115	188.686	34.326	191.273	34.545	193.864	34.775	196.458	35.013	199.055	35.261	201.655	35.518	250	
230	160.293	30.604	162.863	30.771	165.436	30.950	168.013	31.138	170.593	31.337	173.177	31.545	175.764	31.764	178.355	31.993	180.949	32.232	183.546	32.480	186.147	32.740	188.750	33.009	191.357	33.288	230	80 (P)*
200	144.753	26.977	147.332	27.170	149.914	27.375	152.501	27.592	155.091	27.820	157.686	28.059	160.284	28.311	162.885	28.573	165.490	28.848	168.099	29.133	170.711	29.431	173.326	29.739	175.945	30.060	200	
170	129.238	23.420	131.828	23.647	134.422	23.887	137.021	24.142	139.624	24.409	142.232	24.691	144.843	24.986	147.458	25.294	150.077	25.616	152.700	25.952	155.326	26.300	157.955	26.662	160.588	27.038	170	
155	121.493	21.679	124.090	21.928	126.692	22.192	129.298	22.470	131.909	22.763	134.524	23.072	137.143	23.395	139.767	23.732	142.394	24.085	145.024	24.452	147.659	24.834	150.297	25.230	152.937	25.641	155	65 (P)*
125	106.041	18.319	108.656	18.627	111.276	18.953	113.901	19.297	116.531	19.659	119.165	20.040	121.803	20.438	124.445	20.855	127.091	21.290	129.741	21.742	132.394	22.213	135.050	22.701	137.709	23.206	125	
100	93.225	15.727	95.859	16.110	98.499	16.516	101.143	16.944	103.793	17.394	106.446	17.866	109.103	18.361	111.764	18.878	114.427	19.416	117.094	19.976	119.763	20.558	122.434	21.161	125.106	21.786	100	
90	88.121	14.781	90.764	15.205	93.413	15.654	96.067	16.128	98.725	16.627	101.386	17.149	104.051	17.696	106.719	18.267	109.389	18.862	112.061	19.481	114.735	20.123	117.410	20.788	120.086	21.476	90	50 (P)
80	83.034	13.915	86.688	14.390	88.346	14.893	91.009	15.424	93.675	15.981	96.344	16.565	99.016	17.177	101.689	17.814	104.364	18.478	107.040	19.168	109.716	19.883	112.392	20.624	115.068	21.390	80	50 (H)**
70	77.968	13.162	80.632	13.702	83.300	14.273	85.971	14.874	88.644	15.506	91.319	16.168	93.995	16.860	96.671	17.581	99.347	18.330	102.021	19.108	104.694	19.915	107.364	20.749	110.031	21.610	70	
60	72.926	12.575	75.599	13.199	78.273	13.859	80.949	14.553	83.625	15.281	86.301	16.042	88.974	16.837	91.645	17.664	94.312	18.522	96.975	19.412	99.632	20.333	102.283	21.283	104.926	22.263	60	40 (P)*
55	70.413	12.370	73.088	13.047	75.765	13.761	78.440	14.512	81.114	15.299	83.786	16.122	86.453	16.979	89.115	17.870	91.772	18.795	94.421	19.752	97.062	20.741	99.693	21.760	102.315	22.810	55	
50	67.904	12.246	70.580	12.984	73.254	13.762	75.926	14.580	78.594	15.435	81.256	16.328	83.911	17.258	86.558	18.223	89.196	19.223	91.823	20.256	94.438	21.322	97.040	22.419	99.627	23.546	50	40 (H)**
45	65.394	12.228	68.066	13.038	70.734	13.892	73.396	14.787	76.050	15.722	78.695	16.697	81.328	17.710	83.950	18.760	86.557	19.845	89.148	20.964	91.723	22.116	94.279	23.299	96.815	24.512	45	35 (P)*
40	62.875	12.348	65.536	13.246	68.189	14.189	70.830	15.176	73.458	16.205	76.072	17.274	78.668	18.383	81.246	19.529	83.804	20.710	86.238	21.925							40	30 (H)**
35	60.326	12.658	62.963	13.660	65.585	14.710	68.187	15.805	70.769	16.943	73.328	18.121															35	
33	59.290	12.850	61.911	13.900	64.513	14.997	67.092	16.140	69.647	17.326																	33	30 (P)*
30	57.705	13.230	60.292	14.357	62.853	15.533																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	23 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 56 Degrees

$\Delta = 56°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1336.774	331.430	1339.226	331.433	1341.778	331.438	1344.280	331.443	1346.783	331.449	1349.287	331.456	1351.790	331.464	1354.295	331.473	1356.799	331.483	1359.304	331.494	1361.810	331.505	1364.316	331.518	1366.822	331.532	2500	
2250	1177.262	291.659	1179.764	291.663	1182.266	291.668	1184.769	291.674	1187.272	291.681	1189.776	291.689	1192.280	291.698	1194.785	291.708	1197.290	291.719	1199.796	291.732	1202.302	291.745	1204.809	291.760	1207.316	291.775	2250	
2000	1070.920	265.146	1073.422	265.150	1075.925	265.155	1078.428	265.162	1080.932	265.170	1083.436	265.178	1085.940	265.188	1088.446	265.199	1090.951	265.212	1093.458	265.225	1095.965	265.240	1098.472	265.256	1100.980	265.273	2000	
1800	964.579	238.632	967.081	238.637	969.584	238.643	972.087	238.650	974.591	238.658	977.096	238.668	979.601	238.680	982.107	238.692	984.613	238.706	987.120	238.721	989.628	238.737	992.136	238.755	994.645	238.774	1800	
1600	805.067	198.863	807.569	198.868	810.073	198.875	812.577	198.884	815.082	198.894	817.587	198.906	820.093	198.919	822.600	198.934	825.108	198.950	827.616	198.969	830.125	198.988	832.635	199.010	835.146	199.032	1600	
1400	645.555	159.093	648.058	159.100	650.562	159.109	653.067	159.120	655.573	159.132	658.080	159.147	660.588	159.164	663.097	159.183	665.606	159.203	668.116	159.226	670.628	159.250	673.140	159.277	675.653	159.305	1400	
1200	539.214	132.581	541.718	132.589	544.223	132.600	546.729	132.613	549.236	132.628	551.744	132.646	554.253	132.666	556.764	132.688	559.275	132.713	561.788	132.740	564.301	132.770	566.816	132.802	569.332	132.836	1200	
1000	486.044	119.323	488.548	119.334	491.053	119.346	493.560	119.361	496.068	119.377	498.577	119.397	501.087	119.419	503.599	119.444	506.112	119.472	508.625	119.502	511.141	119.535	513.657	119.570	516.174	119.608	1000	
900	432.873	106.070	435.378	106.080	437.885	106.093	440.392	106.109	442.901	106.128	445.411	106.150	447.923	106.176	450.436	106.204	452.950	106.235	455.465	106.269	457.982	106.305	460.501	106.345	463.020	106.388	900	
800	379.703	92.814	382.209	92.826	384.716	92.841	387.224	92.860	389.733	92.882	392.246	92.907	394.760	92.936	397.274	92.968	399.791	93.003	402.309	93.042	404.828	93.084	407.348	93.130	409.871	93.178	800	100 (P)*
700	326.534	79.560	329.040	79.574	331.548	79.591	334.058	79.613	336.570	79.638	339.084	79.668	341.599	79.701	344.116	79.739	346.635	79.780	349.156	79.825	351.678	79.875	354.202	79.927	356.728	79.985	700	
600	273.365	66.306	275.872	66.323	278.382	66.344	280.894	66.370	283.408	66.401	285.924	66.436	288.443	66.476	290.963	66.521	293.486	66.571	296.010	66.625	298.537	66.684	301.066	66.748	303.597	66.816	600	
500	220.196	53.055	222.706	53.075	225.218	53.102	227.733	53.134	230.250	53.173	232.771	53.217	235.293	53.267	237.819	53.323	240.347	53.385	242.877	53.453	245.410	53.526	247.946	53.606	250.484	53.691	500	
450	194.929	47.755	197.440	47.778	200.953	47.807	203.470	47.843	205.989	47.886	208.509	47.935	211.032	47.991	213.557	48.053	216.085	48.122	218.615	48.197	221.630	48.279	224.168	48.367	226.706	48.462	450	
400	169.612	46.430	172.123	46.454	174.636	46.484	177.150	46.521	179.667	46.565	182.186	46.615	184.708	46.673	187.232	46.737	189.758	46.807	192.287	46.885	194.818	46.969	197.351	47.060	199.886	47.158	400	
360	147.029	39.806	149.542	39.834	152.059	39.870	154.578	39.913	157.101	39.964	159.628	40.023	162.158	40.090	164.691	40.164	167.228	40.247	169.768	40.337	172.312	40.436	174.858	40.542	177.408	40.655	360	80 (P)*
320	140.447	33.185	142.962	33.218	145.482	33.260	148.005	33.313	150.533	33.374	153.065	33.445	155.601	33.525	158.140	33.614	160.684	33.713	163.232	33.822	165.783	33.940	168.338	34.067	170.897	34.204	320	
280	120.414	30.537	122.931	30.573	134.852	30.619	137.378	30.676	139.908	30.742	142.442	30.819	144.981	30.906	147.524	31.004	150.071	31.112	152.623	31.229	155.178	31.357	157.738	31.496	160.301	31.644	280	
240	113.866	26.567	116.383	26.608	118.909	26.661	121.439	26.726	123.973	26.803	126.512	26.891	129.057	26.992	131.606	27.104	134.159	27.227	136.718	27.363	139.281	27.510	141.848	27.669	144.420	27.840	240	
200	97.919	22.399	100.441	22.648	102.970	22.710	105.504	22.787	108.044	22.877	110.590	22.981	113.141	23.099	115.698	23.230	118.260	23.376	120.828	23.535	123.401	23.708	125.979	23.895	128.562	24.096	200	65 (P)*
180	89.946	20.617	92.471	20.670	95.001	20.739	97.539	20.822	100.082	20.921	102.632	21.035	105.188	21.164	107.750	21.309	110.318	21.468	112.891	21.643	115.470	21.833	118.055	22.038	120.644	22.257	180	
160	74.003	16.656	76.532	16.722	79.070	16.807	81.616	16.911	84.169	17.033	86.730	17.175	89.298	17.333	91.873	17.514	94.455	17.711	97.043	17.928	99.638	18.162	102.238	18.416	104.845	18.689	160	
140	60.719	13.563	63.256	13.646	65.803	13.752	68.359	13.881	70.924	14.033	73.498	14.211	76.081	14.421	78.672	14.434	81.270	14.681	83.876	14.950	86.489	15.243	89.109	15.559	91.736	15.898	140	
120	49.407	10.738	51.948	10.841	54.492	10.974	57.038	11.136	59.588	11.327	62.137	11.547	64.689	11.797	67.242	12.075	69.798	12.383	72.355	12.719	74.914	13.083	77.475	13.476	80.037	13.898	120	50 (P)*
100	35.407	12.049	37.948	12.141	40.492	12.259	43.038	12.403	45.587	12.573	48.137	12.769	50.689	12.991	53.243	13.239	55.798	13.512	58.355	13.811	60.914	14.136	63.475	14.487	66.037	14.863	100	
90	30.097	10.738	32.642	10.841	35.192	10.974	37.768	11.136	40.348	11.327	42.937	11.547	45.537	11.797	48.145	12.075	50.763	12.383	53.389	12.719	56.022	13.083	58.662	13.476	61.309	13.898	90	50 (H)**
80	44.788	9.432	47.339	9.549	49.904	9.701	52.481	9.886	55.070	10.104	57.670	10.355	60.281	10.640	62.901	10.958	65.531	11.308	68.169	11.691	70.814	12.106	73.467	12.554	76.126	13.033	80	
70	39.482	8.131	42.041	8.268	44.615	8.445	47.203	8.661	49.804	8.915	52.417	9.208	55.041	9.539	57.676	9.908	60.320	10.316	62.972	10.760	65.631	11.243	68.297	11.762	70.968	12.317	70	
65	36.830	7.484	39.394	7.634	41.974	7.827	44.568	8.062	47.177	8.339	49.798	8.658	52.430	9.018	55.072	9.421	57.724	9.864	60.384	10.348	63.050	10.872	65.722	11.435	68.399	12.038	65	40 (P)*
60	34.179	6.841	36.749	7.005	39.326	7.217	41.938	7.475	44.555	7.780	47.184	8.130	49.823	8.526	52.476	8.967	55.136	9.453	57.804	9.983	60.477	10.556	63.155	11.173	65.836	11.832	60	40 (H)**
55	31.531	6.201	34.107	6.384	36.702	6.619	39.313	6.906	41.939	7.243	44.578	7.632	47.229	8.070	49.889	8.559	52.558	9.096	55.237	9.682	57.912	10.315	60.594	10.995	63.277	11.720	55	35 (P)*
50	28.884	5.568	31.469	5.774	34.073	6.038	36.694	6.359	39.331	6.738	41.981	7.174	44.642	7.665	47.312	8.211	49.989	8.817	52.680	9.466	55.382	10.171	58.095	10.928	60.716	11.733	50	35 (H) 30 (P)*
45	26.241	4.943	28.835	5.178	31.451	5.479	34.084	5.845	36.734	6.277	39.395	6.772	42.066	7.330	44.745	7.950	47.427	8.630	50.110	9.368	52.791	10.164	55.468	11.016	58.138	11.821	45	
40	23.184	4.096	25.784	4.945	30.404	5.264	33.043	5.652	35.698	6.109	38.364	6.633	41.039	7.223	43.720	7.877	46.403	8.595	49.085	9.374	51.764	10.212	54.435	11.107	57.096	12.058	40	
35	23.661	4.350	26.209	4.604	28.838	4.954	31.486	5.380	34.148	5.881	36.822	6.454	39.502	7.099	42.185	7.814	44.867	8.595	47.544	9.442	50.213	10.351	52.870	11.321	55.510	12.344	35	30 (H)**
30	20.985	3.734	23.592	4.065	26.238	4.484	28.902	4.991	31.578	5.587	34.259	6.266	36.942	7.028	39.630	7.868	42.288	8.784	44.940	9.771	47.571	10.825	50.177	11.942	52.752	13.118	30	
25	18.919	3.509	22.549	3.864	25.203	4.318	27.873	4.863	30.553	5.511	33.236	6.245	35.916	7.065	38.585	7.967	41.239	8.948	43.871	10.002	46.474	11.125	49.043	12.311			25	25 (P)*
23	18.387	3.180	20.991	3.587	23.656	4.106	26.334	4.733	29.017	5.464	31.696	6.295	34.362	7.219	37.007	8.232	39.623	9.326	42.202	10.495							23	25 (H)**
20	15.740	2.690	18.217	3.127	21.092	3.907	23.772	4.721	26.435	5.660	29.066	6.714	31.651	7.871													20	20 (P)*
15	15.225	2.407	17.898	3.180	20.580	3.904	23.255	4.768	25.905	5.762	28.513	6.873															15	20 (H)**
14																											14	

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 56 Degrees

$\Delta = 56°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1369.329	331.546	1371.836	331.562	1374.344	331.579	1376.852	331.596	1379.360	331.615	1381.869	331.634	1384.379	331.654	1386.889	331.675	1389.399	331.698	1391.910	331.721	1394.421	331.745	1396.932	331.770	1399.444	331.796	2500	
2200	1209.823	291.792	1212.332	291.809	1214.841	291.828	1217.350	291.848	1219.860	291.869	1222.370	291.891	1224.880	291.914	1227.392	291.938	1229.903	291.963	1232.415	291.990	1234.928	292.017	1237.441	292.046	1239.955	292.075	2200	
2000	1103.488	265.292	1105.997	265.311	1108.507	265.332	1111.017	265.354	1113.528	265.376	1116.039	265.401	1118.551	265.426	1121.063	265.452	1123.576	265.480	1126.089	265.509	1128.603	265.539	1131.117	265.571	1133.632	265.603	2000	
1800	997.154	238.794	999.664	238.816	1002.175	238.839	1004.686	238.863	1007.198	238.889	1009.710	238.916	1012.223	238.944	1014.737	238.973	1017.251	239.004	1019.766	239.036	1022.281	239.069	1024.797	239.104	1027.314	239.140	1800	
1500	837.657	199.057	840.169	199.083	842.682	199.110	845.195	199.139	847.709	199.170	850.224	199.202	852.740	199.236	855.256	199.271	857.773	199.308	860.291	199.347	862.809	199.387	865.328	199.429	867.848	199.472	1500	
1200	678.167	159.336	680.682	159.369	683.198	159.403	685.715	159.439	688.232	159.478	690.751	159.518	693.270	159.560	695.791	159.604	698.312	159.651	700.833	159.699	703.356	159.749	705.880	159.801	708.405	159.855	1200	
1000	571.849	132.872	574.366	132.911	576.885	132.952	579.405	132.996	581.927	133.042	584.448	133.090	586.971	133.141	589.496	133.194	592.021	133.250	594.547	133.307	597.074	133.368	599.602	133.430	602.132	133.495	1000	
900	518.693	119.649	521.213	119.692	523.734	119.738	526.256	119.786	528.779	119.837	531.303	119.891	533.829	119.948	536.356	120.006	538.884	120.068	541.413	120.132	543.943	120.199	546.474	120.269	549.006	120.341	900	
800	465.541	106.434	468.063	106.482	470.587	106.534	473.111	106.588	475.637	106.646	478.165	106.707	480.694	106.770	483.223	106.836	485.755	106.905	488.287	106.978	490.821	107.053	493.356	107.131	495.892	107.212	800	
700	412.394	93.230	414.920	93.286	417.447	93.345	419.975	93.407	422.504	93.473	425.035	93.542	427.568	93.615	430.102	93.691	432.637	93.770	435.174	93.852	437.712	93.938	440.252	94.027	442.793	94.120	700	
600	359.256	80.045	361.785	80.110	364.316	80.179	366.849	80.252	369.383	80.329	371.919	80.409	374.457	80.494	376.996	80.582	379.537	80.675	382.079	80.771	384.624	80.871	387.169	80.975	389.717	81.083	600	
500	306.129	66.889	308.664	66.967	311.201	67.049	313.740	67.137	316.281	67.229	318.823	67.325	321.368	67.427	323.915	67.533	326.463	67.644	329.014	67.759	331.566	67.879	334.121	68.004	336.677	68.134	500	
400	253.025	53.782	255.568	53.880	258.113	53.983	260.661	54.092	263.211	54.207	265.764	54.328	268.319	54.455	270.876	54.587	273.436	54.726	275.998	54.870	278.562	55.020	281.128	55.176	283.697	55.338	400	
360	231.792	48.564	234.340	48.672	236.890	48.787	239.443	48.908	241.998	49.035	244.556	49.169	247.117	49.310	249.680	49.457	252.245	49.611	254.813	49.771	257.384	49.938	259.956	50.111	262.532	50.291	360	100 (P)*
350	226.486	47.262	229.034	47.373	231.586	47.491	234.140	47.616	236.697	47.747	239.256	47.885	241.818	48.030	244.383	48.181	246.950	48.339	249.520	48.504	252.092	48.676	254.667	48.854	257.244	49.039	350	
300	199.961	40.777	202.517	40.907	205.077	41.044	207.639	41.189	210.204	41.343	212.772	41.503	215.344	41.672	217.918	41.849	220.495	42.033	223.074	42.225	225.657	42.425	228.242	42.633	230.831	42.848	300	
250	173.460	34.350	176.026	34.505	178.596	34.670	181.169	34.844	183.746	35.028	186.326	35.220	188.909	35.423	191.496	35.634	194.086	35.855	196.679	36.085	199.275	36.325	201.874	36.574	204.477	36.832	250	
230	162.869	31.803	165.440	31.972	168.015	32.151	170.594	32.340	173.176	32.540	175.762	32.749	178.352	32.969	180.945	33.198	183.541	33.438	186.141	33.688	188.744	33.949	191.350	34.219	193.959	34.499	230	80 (P)*
200	146.996	28.022	149.577	28.216	152.162	28.422	154.750	28.639	157.343	28.868	159.940	29.109	162.540	29.361	165.144	29.625	167.752	29.901	170.364	30.188	172.979	30.487	175.597	30.797	178.219	31.119	200	
170	131.149	24.310	133.742	24.538	136.339	24.780	138.940	25.035	141.546	25.304	144.156	25.587	146.770	25.883	149.388	26.193	152.011	26.517	154.636	26.853	157.266	27.204	159.899	27.568	162.536	27.945	170	
155	123.239	22.492	125.839	22.742	128.443	23.007	131.052	23.287	133.666	23.582	136.284	23.891	138.907	24.216	141.533	24.555	144.164	24.909	146.798	25.278	149.436	25.661	152.078	26.060	154.723	26.472	155	65 (P)*
125	107.458	18.979	110.076	19.288	112.699	19.615	115.327	19.961	117.960	20.325	120.598	20.707	123.240	21.108	125.887	21.526	128.537	21.963	131.191	22.418	133.849	22.890	136.510	23.380	139.173	23.888	125	
100	94.368	16.260	97.007	16.645	99.650	17.052	102.299	17.482	104.953	17.934	107.611	18.409	110.273	18.906	112.939	19.425	115.608	19.966	118.280	20.529	120.954	21.113	123.631	21.719	126.310	22.346	100	
90	89.156	15.264	91.804	15.690	94.458	16.141	97.116	16.617	99.778	17.117	102.445	17.642	105.115	18.192	107.789	18.765	110.465	19.363	113.143	19.984	115.823	20.629	118.505	21.298	121.188	21.989	90	50 (P)
80	83.962	14.347	86.621	14.825	89.284	15.330	91.952	15.863	94.624	16.423	97.299	17.010	99.976	17.624	102.656	18.264	105.338	18.931	108.020	19.624	110.704	20.343	113.387	21.087	116.070	21.856	80	50 (H)**
70	78.790	13.545	81.460	14.087	84.133	14.661	86.810	15.265	89.489	15.900	92.171	16.565	94.853	17.260	97.537	17.984	100.220	18.737	102.902	19.519	105.583	20.329	108.261	21.166	110.936	22.031	70	
60	73.643	12.909	76.322	13.536	79.003	14.198	81.686	14.896	84.369	15.627	87.052	16.392	89.734	17.190	92.413	18.021	95.088	18.884	97.760	19.778	100.426	20.703	103.086	21.658	105.739	22.642	60	40 (P)*
55	71.079	12.680	73.761	13.360	76.444	14.077	79.127	14.832	81.809	15.623	84.488	16.449	87.164	17.310	89.836	18.206	92.501	19.135	95.160	20.096	97.810	21.089	100.452	22.114	103.084	23.168	55	
50	68.519	12.533	71.202	13.274	73.884	14.056	76.564	14.877	79.240	15.737	81.911	16.634	84.576	17.558	87.232	18.537	89.880	19.541	92.517	20.579	95.143	21.650	97.756	22.752	100.354	23.885	50	40 (H)**
45	65.960	12.491	68.640	13.305	71.316	14.163	73.987	15.062	76.650	16.002	79.304	16.981	81.948	17.999	84.580	19.053	87.198	20.143	89.800	21.267	92.386	22.425	94.954	23.613	97.502	24.832	45	35 (P)*
40	63.392	12.589	66.062	13.491	68.724	14.428	71.375	15.430	74.014	16.463	76.638	17.538	79.246	18.652	81.835	19.803	84.404	20.989	86.951	22.210							40	30 (H)**
35	60.797	12.878	63.444	13.884	66.076	14.939	68.689	16.038	71.283	17.182[5]	73.853	18.366															35	
33	59.743	13.061	62.375	14.116	64.988	15.218	67.578	16.367	70.144	17.558																	33	30 (P)*
30	58.132	13.429	60.730	14.561	63.303	15.742																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 57 Degrees

$\Delta = 57°$

Rc	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		Rc	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1364.890	344.731	1367.392	344.739	1369.894	344.744	1372.396	344.749	1374.899	344.755	1377.403	344.762	1379.906	344.770	1382.411	344.779	1384.916	344.789	1387.421	344.800	1389.926	344.812	1392.432	344.825	1394.939	344.838	2500	
2200	1202.004	303.369	1204.506	303.373	1207.008	303.377	1209.511	303.384	1212.014	303.390	1214.518	303.398	1217.022	303.408	1219.527	303.418	1222.032	303.429	1224.538	303.441	1227.045	303.455	1229.552	303.469	1232.059	303.485	2200	
2000	1093.413	275.791	1095.915	275.795	1098.417	275.800	1100.921	275.807	1103.425	275.815	1105.929	275.823	1108.434	275.833	1110.939	275.845	1113.445	275.857	1115.951	275.871	1118.458	275.886	1120.966	275.902	1123.474	275.919	2000	
1800	984.822	248.213	987.324	248.218	989.827	248.223	992.331	248.230	994.835	248.239	997.340	248.249	999.845	248.260	1002.351	248.273	1004.857	248.287	1007.365	248.302	1009.872	248.318	1012.381	248.336	1014.890	248.355	1800	
1500	821.936	206.846	824.439	206.852	826.942	206.859	829.447	206.867	831.951	206.878	834.457	206.890	836.963	206.903	839.470	206.918	841.978	206.935	844.487	206.953	846.996	206.973	849.506	206.994	852.017	207.017	1500	
1200	659.051	165.480	661.554	165.487	664.058	165.496	666.563	165.507	669.069	165.520	671.576	165.535	674.084	165.551	676.593	165.570	679.103	165.591	681.614	165.614	684.125	165.638	686.638	165.665	689.151	165.694	1200	
1000	550.460	137.903	552.964	137.912	555.469	137.922	557.976	137.936	560.483	137.951	562.991	137.969	565.501	137.989	568.011	138.011	570.523	138.036	573.036	138.063	575.550	138.093	578.065	138.125	580.581	138.159	1000	
900	496.166	124.115	498.670	124.125	501.176	124.136	503.682	124.151	506.190	124.168	508.700	124.188	511.210	124.210	513.722	124.235	516.235	124.263	518.749	124.293	521.264	124.326	523.781	124.362	526.299	124.400	900	
800	441.871	110.327	444.375	110.338	446.882	110.351	449.389	110.367	451.899	110.387	454.409	110.409	456.921	110.434	459.434	110.462	461.949	110.493	464.465	110.528	466.982	110.564	469.500	110.604	472.021	110.647	800	
700	387.376	96.540	390.082	96.552	392.589	96.567	395.097	96.586	397.608	96.608	400.120	96.633	402.634	96.662	405.148	96.694	407.665	96.730	410.183	96.769	412.703	96.811	415.224	96.857	417.747	96.906	700	100 (P)*
600	333.282	82.753	335.786	82.767	338.297	82.785	340.807	82.807	343.319	82.832	345.833	82.862	348.349	82.896	350.866	82.933	353.385	82.975	355.906	83.020	358.429	83.070	360.954	83.123	363.480	83.180	600	
500	278.988	68.968	281.496	68.984	284.006	69.006	286.518	69.032	289.032	69.063	291.549	69.098	294.068	69.138	296.589	69.183	299.112	69.233	301.637	69.288	304.164	69.347	306.694	69.411	309.225	69.480	500	
400	224.695	55.184	227.205	55.205	229.717	55.231	232.232	55.264	234.750	55.302	237.271	55.347	239.794	55.397	242.320	55.454	244.849	55.515	247.380	55.584	249.914	55.658	252.450	55.738	254.989	55.823	400	
360	202.978	49.671	205.489	49.694	208.003	49.724	210.520	49.760	213.040	49.803	215.562	49.852	218.088	49.908	220.617	49.970	223.149	50.040	225.683	50.115	228.220	50.198	230.761	50.286	233.304	50.382	360	
320	197.349	48.293	200.060	48.317	202.574	48.347	205.092	48.385	207.612	48.429	210.136	48.479	212.662	48.537	215.192	48.601	217.724	48.672	220.260	48.750	222.798	48.835	225.339	48.926	227.883	49.024	320	80 (P)*
300	170.403	41.403	172.916	41.431	175.433	41.467	177.953	41.510	180.477	41.562	183.004	41.621	185.535	41.688	188.069	41.763	190.607	41.846	193.148	41.937	195.692	42.035	198.240	42.142	200.791	42.256	300	
250	143.239	34.516	145.734	34.549	148.294	34.592	150.818	34.644	153.347	34.706	155.879	34.777	158.416	34.857	160.957	34.947	163.501	35.047	166.050	35.156	168.603	35.274	171.159	35.402	173.719	35.539	250	
230	132.402	31.782	134.918	31.798	137.440	31.844	139.966	31.901	142.497	31.968	145.032	32.045	147.572	32.133	150.116	32.230	152.664	32.339	155.217	32.457	157.773	32.586	160.334	32.725	162.899	32.874	230	
200	116.116	27.632	118.635	27.673	121.160	27.727	123.690	27.792	126.225	27.869	128.765	27.958	131.311	28.058	133.861	28.171	136.416	28.295	138.975	28.431	141.540	28.579	144.109	28.739	146.683	28.910	200	
170	99.832	23.503	102.354	23.553	104.883	23.616	107.418	23.693	109.959	23.783	112.506	23.888	115.059	24.006	117.617	24.138	120.181	24.285	122.750	24.445	125.324	24.619	127.904	24.806	130.489	25.008	170	65 (P)*
155	91.690	21.442	94.215	21.496	96.747	21.564	99.285	21.649	101.829	21.748	104.380	21.863	106.938	21.992	109.501	22.137	112.070	22.298	114.645	22.473	117.226	22.664	119.813	22.869	122.404	23.090	155	
125	75.409	17.322	77.940	17.388	80.478	17.474	83.025	17.578	85.580	17.701	88.142	17.843	90.711	18.004	93.288	18.183	95.872	18.382	98.462	18.599	101.059	18.835	103.662	19.090	106.272	19.363	125	
100	61.845	13.886	64.383	13.979	66.930	14.085	69.488	14.216	72.055	14.369	74.630	14.547	77.215	14.748	79.808	14.972	82.409	15.220	85.018	15.491	87.634	15.785	90.257	16.102	92.887	16.443	100	
90	56.421	12.729	58.962	12.821	61.515	12.739	64.078	12.864	66.651	13.055	69.235	13.252	71.827	13.475	74.428	13.724	77.038	13.999	79.657	14.299	82.282	14.626	84.915	14.978	87.555	15.355	90	50 (P)*
80	50.998	11.165	53.544	11.268	56.103	11.402	58.673	11.564	61.254	11.756	63.846	11.978	66.448	12.228	69.060	12.508	71.680	12.817	74.309	13.154	76.946	13.521	79.591	13.916	82.242	14.339	80	50 (H)**
70	45.577	9.805	48.129	9.923	50.695	10.075	53.274	10.261	55.865	10.480	58.468	10.733	61.082	11.019	63.705	11.338	66.338	11.690	68.980	12.075	71.630	12.492	74.287	12.942	76.950	13.424	70	
60	40.158	8.451	42.719	8.589	45.295	8.767	47.885	8.983	50.489	9.239	53.104	9.533	55.732	9.866	58.370	10.237	61.018	10.646	63.674	11.093	66.339	11.577	69.009	12.099	71.686	12.657	60	40 (P)*
55	37.450	7.778	40.016	7.929	42.598	8.122	45.195	8.358	47.806	8.636	50.430	8.957	53.066	9.319	55.712	9.723	58.368	10.169	61.033	10.655	63.704	11.181	66.382	11.748	69.065	12.353	55	
50	34.744	7.108	37.315	7.273	39.904	7.486	42.509	7.745	45.128	8.051	47.761	8.403	50.406	8.801	53.062	9.244	55.727	9.732	58.399	10.265	61.078	10.841	63.762	11.461	66.450	12.123	50	40 (H)**
45	32.038	6.442	34.617	6.626	37.214	6.862	39.828	7.150	42.458	7.489	45.101	7.879	47.756	8.320	50.421	8.810	53.095	9.350	55.775	9.939	58.461	10.575	61.150	11.258	63.840	11.987	45	35 (P)*
40	29.317	5.762	31.923	5.949	34.530	6.254	37.155	6.577	39.795	6.958	42.450	7.395	45.115	7.889	47.791	8.438	50.477	9.041	53.169	9.698	55.850	10.407	58.541	11.167	61.239	11.978	40	35 (H) 30 (P)*
35	26.637	5.131	29.234	5.367	31.839	5.669	34.490	6.037	37.143	6.471	39.810	6.969	42.487	7.529	45.171	8.152	47.860	8.815	50.550	9.577	53.240	10.377	55.925	11.232	58.604	12.141	35	
33	25.559	4.873	28.160	5.123	30.784	5.444	33.427	5.834	36.086	6.293	38.738	6.819	41.439	7.412	44.126	8.070	46.816	8.790	49.506	9.573	52.193	10.415	54.873	11.314	57.543	12.269	33	
30	23.942	4.492	26.552	4.766	29.165	5.118	31.837	5.547	34.505	6.049	37.184	6.626	39.870	7.274	42.560	7.991	45.250	8.777	47.936	9.627	50.614	10.541	53.280	11.515	55.931	12.547	30	30 (H)**
25	21.254	3.873	23.881	4.202	26.531	4.622	29.200	5.132	31.881	5.730	34.570	6.413	37.260	7.178	39.947	8.022	42.621	8.943	45.285	9.934	47.927	10.993	50.544	12.116	53.131	13.298	25	
23	20.182	3.604	22.816	3.991	25.474	4.446	28.150	4.999	30.836	5.645	33.526	6.382	36.214	7.206	38.893	8.113	41.566	9.098	44.198	10.158	46.813	11.285	49.394	12.477			23	25 (P)*
20	18.577	3.289	21.225	3.698	23.895	4.219	26.580	4.849	29.270	5.594	31.957	6.418	34.632	7.347	37.287	8.384	39.914	9.464	42.509	10.638							20	25 (H)**
15	15.919	2.773	18.592	3.313	21.280	3.996	23.966	4.814	26.640	5.757	29.282	6.816	31.878	7.979													15	20 (P)*
14	15.190	2.685	18.068	3.261	20.758	3.988	23.441	4.856	26.101	5.855	28.720	6.921															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Step Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 57 Degrees

$\Delta = 57°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre.			
2500	1397.446	344.853	1399.953	344.869	1402.461	344.885	1404.969	344.903	1407.476	344.922	1409.987	344.941	1412.497	344.961	1415.007	344.983	1417.517	345.005	1420.028	345.028	1422.540	345.052	1425.051	345.077	1427.564	345.104	2500	
2200	1234.567	303.502	1237.075	303.529	1239.584	303.559	1242.094	303.558	1244.604	303.580	1247.114	303.602	1249.625	303.625	1252.136	303.649	1254.648	303.674	1257.161	303.701	1259.673	303.728	1262.187	303.757	1264.701	303.786	2200	
2000	1125.982	275.937	1128.492	275.957	1131.001	275.977	1133.512	275.999	1136.023	276.022	1138.534	276.047	1141.046	276.073	1143.559	276.099	1146.072	276.127	1148.585	276.156	1151.100	276.186	1153.614	276.218	1156.129	276.250	2000	
1800	1017.399	248.375	1019.910	248.397	1022.420	248.420	1024.932	248.445	1027.444	248.470	1029.957	248.497	1032.470	248.526	1034.984	248.555	1037.498	248.586	1040.013	248.618	1042.529	248.652	1045.045	248.687	1047.562	248.723	1800	
1500	854.529	207.041	857.041	207.067	859.554	207.095	862.068	207.125	864.582	207.155	867.097	207.187	869.613	207.222	872.129	207.257	874.647	207.294	877.165	207.333	879.684	207.373	882.203	207.415	884.723	207.458	1500	
1200	691.666	165.724	694.181	165.757	696.697	165.791	699.214	165.828	701.732	165.866	704.251	165.907	706.771	165.949	709.291	165.994	711.813	166.040	714.335	166.089	716.859	166.139	719.383	166.191	721.908	166.246	1200	
1000	583.098	138.196	585.616	138.235	588.135	138.277	590.656	138.321	593.177	138.367	595.700	138.415	598.223	138.466	600.748	138.520	603.274	138.575	605.801	138.633	608.329	138.694	610.857	138.757	613.387	138.822	1000	
900	528.818	124.441	531.338	124.484	533.860	124.530	536.382	124.579	538.906	124.630	541.431	124.684	543.957	124.741	546.484	124.800	549.013	124.862	551.542	124.926	554.073	124.994	556.605	125.063	559.138	125.136	900	
800	474.542	110.693	477.065	110.742	479.589	110.794	482.114	110.849	484.640	110.907	487.168	110.968	489.698	111.031	492.228	111.098	494.760	111.167	497.293	111.240	499.828	111.315	502.363	111.394	504.900	111.475	800	
700	420.271	96.958	422.797	97.014	425.324	97.073	427.853	97.136	430.383	97.202	432.915	97.271	435.448	97.344	437.983	97.421	440.519	97.500	443.057	97.583	445.596	97.669	448.136	97.759	450.678	97.852	700	
600	366.009	83.241	368.539	83.307	371.070	83.376	373.604	83.449	376.139	83.526	378.675	83.606	381.214	83.692	383.754	83.781	386.296	83.873	388.839	83.970	391.385	84.071	393.931	84.175	396.480	84.283	600	
560	341.759	69.553	314.294	69.631	316.832	69.714	319.372	69.802	321.913	69.894	324.457	69.991	327.003	70.093	329.550	70.200	332.100	70.311	334.652	70.427	337.205	70.548	339.761	70.674	342.318	70.803	560	
500	257.531	55.916	260.074	56.013	262.621	56.117	265.170	56.226	267.721	56.342	270.275	56.463	272.831	56.590	275.390	56.724	277.951	56.863	280.514	57.006	283.080	57.158	285.648	57.315	288.218	57.478	500	
460	235.850	50.484	238.398	50.592	240.949	50.708	243.503	50.829	246.060	50.957	248.619	51.092	251.181	51.234	253.745	51.382	256.313	51.536	258.882	51.697	261.454	51.865	264.029	52.039	266.606	52.219	460	100 (P)*
450	230.430	49.129	232.980	49.241	235.533	49.359	238.088	49.484	240.646	49.616	243.207	49.755	245.771	49.900	248.337	50.052	250.905	50.211	253.477	50.376	256.051	50.549	258.627	50.728	261.206	50.914	450	
400	203.345	42.379	205.903	42.509	208.463	42.647	211.027	42.793	213.594	42.947	216.164	43.108	218.736	43.278	221.312	43.455	223.891	43.640	226.473	43.833	229.057	44.034	231.645	44.243	234.235	44.459	400	
350	176.283	35.686	178.851	35.842	181.422	36.008	183.997	36.183	186.576	36.367	189.158	36.561	191.743	36.764	194.332	36.977	196.924	37.198	199.520	37.430	202.118	37.670	204.720	37.921	207.325	38.180	350	
320	165.468	33.033	168.041	33.203	170.618	33.383	173.199	33.573	175.783	33.773	178.371	33.984	180.963	34.205	183.558	34.436	186.157	34.677	188.759	34.928	191.365	35.189	193.974	35.461	196.586	35.742	320	80 (P)*
300	149.261	29.064	151.843	29.289	154.430	29.495	157.021	29.714	159.616	29.944	162.215	30.186	164.818	30.439	167.425	30.704	170.035	30.981	172.649	31.270	175.267	31.570	177.889	31.881	180.514	32.205	300	
270	133.079	25.223	135.673	25.452	138.273	25.695	140.877	25.952	143.485	26.222	146.098	26.506	148.715	26.804	151.337	27.115	153.962	27.440	156.591	27.779	159.224	28.131	161.861	28.496	164.501	28.875	270	
255	125.001	23.326	127.603	23.577	130.211	23.844	132.823	24.125	135.439	24.421	138.061	24.732	140.686	25.058	143.316	25.399	145.950	25.753	148.588	26.125	151.230	26.510	153.876	26.911	156.525	27.325	255	65 (P)*
225	108.887	19.655	111.508	19.966	114.135	20.295	116.767	20.642	119.403	21.008	122.045	21.392	124.691	21.794	127.342	22.215	129.996	22.654	132.655	23.110	135.317	23.585	137.983	24.078	140.652	24.588	225	
200	95.523	16.606	98.165	17.193	100.813	17.602	103.466	18.034	106.124	18.488	108.787	18.965	111.454	19.465	114.124	19.986	116.799	20.530	119.476	21.095	122.157	21.682	124.840	22.291	127.523	22.921	200	
180	90.202	15.738	92.854	16.186	95.512	16.640	98.174	17.118	100.842	17.621	103.514	18.148	106.190	18.700	108.869	19.277	111.551	19.877	114.235	20.501	116.922	21.149	119.610	21.821	122.300	22.515	180	50 (P)
170	84.899	14.791	87.562	15.270	90.231	15.778	92.904	16.313	95.581	16.876	98.262	17.466	100.946	18.083	103.632	18.726	106.320	19.396	109.010	20.092	111.700	20.814	114.391	21.562	117.081	22.335	170	50 (H)**
150	79.620	13.917	82.294	14.482	84.974	15.058	87.656	15.666	90.342	16.304	93.030	16.972	95.720	17.670	98.410	18.397	101.101	19.154	103.791	19.939	106.480	20.753	109.166	21.595	111.850	22.464	150	40 (P)*
140	74.367	13.251	77.053	13.882	79.740	14.547	82.430	15.248	85.120	15.982	87.811	16.751	90.500	17.553	93.187	18.388	95.872	19.255	98.552	20.153	101.227	21.082	103.897	22.041	106.560	23.030	140	
125	71.751	12.998	74.440	13.681	77.130	14.402	79.821	15.160	82.510	15.954	85.198	16.785	87.882	17.650	90.562	18.550	93.237	19.483	95.905	20.449	98.566	21.447	101.218	22.476	103.860	23.536	125	
110	69.140	12.827	71.830	13.572	74.520	14.357	77.208	15.182	79.893	16.046	82.573	16.947	85.247	17.885	87.913	18.859	90.571	19.868	93.216	20.911	95.854	21.987	98.478	23.094	101.088	24.232	110	40 (H)**
95	66.331	12.761	69.219	13.579	71.904	14.441	74.583	15.344	77.256	16.289	79.920	17.273	82.574	18.295	85.216	19.354	87.845	20.449	90.458	21.579	93.056	22.741	95.635	23.936	98.196	25.160	95	35 (P)*
90	63.914	12.836	66.594	13.742	69.265	14.694	71.926	15.690	74.575	16.729	77.209	17.808	79.828	18.927	82.428	20.084	85.009	21.276	87.568	22.502							90	30 (H)**
85	61.273	13.103	63.900	14.114	66.522	15.173	69.196	16.278	71.801	17.427	74.383	18.617															85	
80	58.603	13.278	62.843	14.337	65.466	15.445	68.068	16.599	70.646	17.795																	80	30 (P)*
75	58.563	13.633	61.173	14.771	63.757	15.957																					75	30 (H)**
72																											72	25 (P)*
70																											70	
65																											65	25 (H)**
60																											60	20 (P)*
55																											55	20 (H)**
50																											50	
45																											45	
40																											40	
35																											35	
33																											33	
30																											30	
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 58 Degrees

$\Delta = 58°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed Km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	1393.273	358.388	1395.775	358.391	1398.277	358.396	1400.780	358.401	1403.282	358.407	1405.786	358.414	1408.290	358.422	1410.794	358.431	1413.299	358.441	1415.804	358.452	1418.310	358.464	1420.816	358.477	1423.323	358.491	2500	
2250	1226.981	315.362	1229.483	315.386	1231.985	315.391	1234.488	315.397	1236.991	315.404	1239.495	315.412	1242.000	315.421	1244.505	315.432	1247.010	315.443	1249.516	315.456	1252.023	315.469	1254.530	315.484	1257.037	315.499	2250	
2000	1116.120	286.712	1118.622	286.716	1121.124	286.722	1123.627	286.729	1126.131	286.736	1128.635	286.745	1131.140	286.755	1133.646	286.766	1136.152	286.779	1138.658	286.793	1141.166	286.808	1143.673	286.823	1146.181	286.841	2000	
1800	1005.258	258.042	1007.760	258.047	1010.263	258.053	1012.767	258.060	1015.271	258.069	1017.776	258.079	1020.281	258.090	1022.787	258.102	1025.294	258.116	1027.801	258.131	1030.309	258.148	1032.818	258.166	1035.327	258.185	1800	
1500	838.966	215.037	841.469	215.043	843.972	215.050	846.477	215.059	848.981	215.069	851.487	215.081	853.994	215.094	856.501	215.109	859.009	215.126	861.518	215.142	864.027	215.165	866.538	215.186	869.049	215.209	1500	
1200	672.675	172.033	675.178	172.040	677.682	172.049	680.188	172.060	682.694	172.073	685.201	172.088	687.709	172.104	690.218	172.124	692.728	172.144	695.239	172.167	697.751	172.192	700.263	172.219	702.777	172.248	1200	
1000	561.814	143.364	564.318	143.373	566.823	143.383	569.329	143.396	571.836	143.412	574.345	143.430	576.855	143.450	579.366	143.473	581.878	143.498	584.391	143.525	586.905	143.555	589.420	143.587	591.937	143.621	1000	
900	506.384	129.030	508.888	129.039	511.394	129.051	513.901	129.066	516.409	129.083	518.918	129.103	521.429	129.125	523.941	129.150	526.455	129.178	528.969	129.209	531.485	129.242	534.002	129.277	536.520	129.316	900	
800	450.953	114.696	453.458	114.707	455.965	114.720	458.472	114.736	460.982	114.756	463.492	114.778	466.005	114.803	468.518	114.832	471.033	114.863	473.549	114.897	476.067	114.934	478.586	114.974	481.106	115.018	800	
700	395.522	100.363	398.029	100.375	400.536	100.390	403.045	100.408	405.556	100.431	408.068	100.456	410.582	100.485	413.097	100.517	415.614	100.553	418.133	100.593	420.653	100.635	423.175	100.681	425.698	100.730	700	100 (P)*
600	340.094	86.030	342.601	86.044	345.109	86.062	347.619	86.083	350.132	86.109	352.646	86.139	355.162	86.173	357.680	86.210	360.199	86.252	362.721	86.298	365.245	86.348	367.770	86.401	370.297	86.459	600	
500	284.665	71.698	287.173	71.715	289.683	71.736	292.195	71.762	294.710	71.793	297.227	71.829	299.746	71.870	302.268	71.915	304.791	71.965	307.317	72.020	309.845	72.079	312.375	72.144	314.907	72.213	500	
450	229.236	57.368	231.746	57.389	234.259	57.416	236.775	57.448	239.293	57.487	241.814	57.532	244.338	57.583	246.865	57.639	249.394	57.701	251.926	57.770	254.460	57.844	256.997	57.925	259.537	58.011	450	
400	207.065	51.637	209.577	51.660	212.091	51.690	214.608	51.726	217.128	51.770	219.652	51.819	222.178	51.875	224.707	50.514	227.240	52.008	229.775	52.083	232.313	52.166	234.854	52.255	237.398	52.351	400	
350	201.523	50.204	204.034	50.228	206.549	50.259	209.066	50.296	211.587	50.340	214.111	50.391	216.638	50.449	219.169	50.514	221.702	50.585	224.238	50.664	226.777	50.749	229.319	50.840	231.865	50.939	350	
300	173.810	43.042	176.323	43.070	178.840	43.105	181.361	43.149	183.885	43.201	186.413	43.260	188.944	43.328	191.479	43.403	194.018	43.486	196.560	43.577	199.105	43.677	201.654	43.784	204.206	43.899	300	80 (P)*
250	146.098	35.881	148.614	35.915	151.134	35.958	153.658	36.010	156.187	36.072	158.721	36.143	161.258	36.224	163.800	36.315	166.345	36.415	168.895	36.524	171.449	36.643	174.007	36.771	176.568	36.909	250	
230	135.013	33.018	137.530	33.054	140.052	33.101	142.579	33.158	145.111	33.225	147.647	33.303	150.187	33.391	152.732	33.489	155.281	33.598	157.835	33.717	160.393	33.846	162.956	33.985	165.522	34.135	230	
200	118.387	28.724	120.907	28.766	123.432	28.820	125.963	28.885	128.499	28.962	131.040	29.052	133.586	29.153	136.137	29.266	138.693	29.391	141.255	29.528	143.821	29.676	146.391	29.837	148.967	30.009	200	
175	101.763	24.433	104.286	24.482	106.815	24.545	109.351	24.622	111.893	24.713	114.440	24.818	116.994	24.937	119.554	25.070	122.119	25.217	124.690	25.378	127.266	25.553	129.848	25.741	132.435	25.944	175	65 (P)*
150	93.451	22.289	95.976	22.343	98.508	22.412	101.047	22.496	103.593	22.596	106.145	22.711	108.704	22.842	111.268	22.987	113.839	23.148	116.416	23.325	118.999	23.516	121.587	23.723	124.181	23.945	150	
125	76.829	18.005	79.360	18.072	81.900	18.157	84.448	18.262	87.003	18.386	89.567	18.528	92.138	18.690	94.717	18.871	97.302	19.070	99.895	19.288	102.494	19.526	105.100	19.781	107.712	20.056	125	
100	62.981	14.641	65.520	14.726	68.069	14.833	70.627	14.964	73.196	14.918	75.773	15.096	78.360	15.298	80.955	15.524	83.558	15.773	86.170	16.045	88.789	16.341	91.415	16.660	94.048	17.002	100	
90	57.444	13.021	59.986	13.113	62.540	13.232	65.105	13.378	67.680	13.549	70.265	13.747	72.859	13.971	75.463	14.221	78.076	14.498	80.697	14.800	83.326	15.128	85.963	15.482	88.606	15.861	90	50 (P)*
80	51.907	11.802	54.455	11.706	57.015	11.840	59.587	12.004	62.170	12.197	64.764	12.419	67.368	12.671	69.983	12.952	72.606	13.262	75.239	13.601	77.879	13.969	80.528	14.366	83.183	14.792	80	50 (H)**
70	46.373	10.188	48.927	10.307	51.494	10.460	54.075	10.646	56.668	10.867	59.274	11.120	61.890	11.408	64.517	11.728	67.153	12.082	69.799	12.469	72.455	12.888	75.114	13.340	77.783	13.824	70	
60	40.841	8.780	43.403	8.918	45.981	9.087	48.573	9.314	51.179	9.571	53.798	9.867	56.429	10.201	59.071	10.574	61.723	10.985	64.384	11.434	67.053	11.921	69.729	12.445	72.411	13.006	60	40 (P)*
55	38.077	8.079	40.644	8.230	43.227	8.425	45.827	8.662	48.441	8.942	51.068	9.264	53.707	9.628	56.358	10.034	59.018	10.481	61.688	10.970	64.365	11.499	67.048	12.068	69.737	12.677	55	
50	35.314	7.382	37.887	7.548	40.477	7.762	43.085	8.022	45.708	8.330	48.344	8.683	50.993	9.083	53.653	9.529	56.323	10.019	59.001	10.554	61.685	11.133	64.376	11.756	67.070	12.421	50	40 (H)**
45	32.552	6.689	35.132	6.874	37.732	7.111	40.349	7.400	42.981	7.741	45.628	8.133	48.288	8.576	50.958	9.069	53.637	9.611	56.324	10.202	59.015	10.847	61.717	11.528	64.429	12.250	45	35 (P)*
40	29.793	6.002	32.382	6.209	34.991	6.476	37.619	6.801	40.264	7.183	42.922	7.623	45.593	8.119	48.274	8.670	50.962	9.277	53.656	9.937	56.353	10.649	59.051	11.413	61.748	12.227	40	35 (H) 30 (P)*
35	27.038	5.323	29.637	5.560	32.258	5.864	34.899	6.234	37.557	6.670	40.229	7.170	42.911	7.733	45.602	8.359	48.297	9.045	50.995	9.761	53.692	10.504	56.386	11.284	59.074	12.107	35	
33	25.936	5.055	28.541	5.306	31.168	5.628	33.815	6.020	36.478	6.481	39.155	7.010	41.842	7.606	44.536	8.267	47.233	8.991	49.931	9.777	52.626	10.623	55.315	11.527	57.995	12.487	33	
30	24.286	4.657	26.899	4.933	29.535	5.287	32.192	5.717	34.864	6.222	37.549	6.801	40.242	7.452	42.939	8.174	45.637	8.963	48.331	9.817	51.018	10.726	53.694	11.714	56.355	12.751	30	30 (H)**
25	21.547	4.011	24.172	4.342	26.827	4.764	29.500	5.277	32.168	5.878	34.883	6.564	37.581	7.333	40.276	8.181	42.962	9.105	45.634	10.102	48.286	11.166	50.914	12.294	-53.513	13.481	25	
23	20.448	3.761	23.085	4.120	25.748	4.578	28.429	5.133	31.122	5.783	33.819	6.523	36.516	7.351	39.203	8.262	41.877	9.252	44.529	10.317	47.155	11.450	49.748	12.647			23	25 (P)*
20	18.810	3.400	21.461	3.811	24.137	4.335	26.828	4.968	29.526	5.707	32.221	6.545	34.905	7.478	37.570	8.501	40.208	9.605	42.810	10.785							20	25 (H)**
15	16.096	2.859	18.775	3.401	21.470	4.087	24.166	4.909	26.847	5.857	29.499	6.921	32.108	8.089													15	20 (P)*
14	15.557	2.765	18.241	3.344	20.938	4.074	23.630	4.947	26.299	5.950	28.930	7.071															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 58 Degrees

$\Delta = 58°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	1425.830	358.506	1428.337	358.521	1430.845	358.538	1433.354	358.556	1435.863	358.574	1438.372	358.594	1440.882	358.614	1443.392	358.636	1445.903	358.658	1448.414	358.681	1450.926	358.706	1453.438	358.731	1455.950	358.757	2500	
2200	1259.545	315.516	1262.054	315.534	1264.563	315.553	1267.073	315.573	1269.583	315.594	1272.093	315.616	1274.604	315.640	1277.116	315.664	1279.628	315.689	1282.141	315.716	1284.654	315.744	1287.168	315.772	1289.682	315.802	2200	
2000	1148.690	286.859	1151.200	286.879	1153.710	286.900	1156.220	286.922	1158.731	286.945	1161.243	286.969	1163.755	286.995	1166.268	287.022	1168.781	287.050	1171.295	287.079	1173.810	287.109	1176.325	287.141	1178.840	287.174	2000	
1860	1037.837	258.206	1040.347	258.228	1042.858	258.251	1045.370	258.275	1047.882	258.301	1050.395	258.328	1052.909	258.356	1055.423	258.386	1057.938	258.417	1060.453	258.450	1062.969	258.483	1065.486	258.519	1068.003	258.555	1860	
1500	871.560	215.233	874.073	215.260	876.586	215.288	879.100	215.317	881.615	215.348	884.130	215.380	886.647	215.415	889.163	215.450	891.681	215.487	894.200	215.527	896.719	215.567	899.239	215.609	901.759	215.653	1500	
1200	705.292	172.278	707.808	172.311	710.324	172.346	712.841	172.382	715.360	172.421	717.879	172.462	720.399	172.505	722.920	172.549	725.442	172.596	727.965	172.644	730.489	172.695	733.014	172.748	735.540	172.802	1200	
1000	594.454	143.658	596.973	143.698	599.493	143.739	602.013	143.783	604.535	143.830	607.058	143.878	609.582	143.930	612.108	143.983	614.634	144.039	617.161	144.098	619.690	144.158	622.219	144.222	624.750	144.287	1000	
900	539.039	129.357	541.560	129.401	544.082	129.447	546.605	129.496	549.129	129.547	551.655	129.602	554.181	129.658	556.709	129.718	559.238	129.780	561.769	129.845	564.300	129.913	566.833	129.982	569.366	130.055	900	
800	483.628	115.064	486.151	115.113	488.676	115.165	491.202	115.220	-493.729	115.278	496.258	115.339	498.788	115.403	501.319	115.470	503.851	115.540	506.385	115.613	508.920	115.689	511.457	115.768	513.995	115.850	800	
700	428.223	100.783	430.749	100.819	433.277	100.899	435.806	100.961	438.337	101.028	440.870	101.097	443.404	101.171	445.939	101.247	448.476	101.327	451.015	101.410	453.555	101.497	456.096	101.587	458.639	101.681	700	
600	372.825	85.520	375.356	86.586	377.888	86.655	380.422	86.729	382.958	86.806	385.496	86.887	388.035	86.973	390.576	87.062	393.119	87.155	395.664	87.252	398.210	87.353	400.758	87.458	403.307	87.567	600	
500	317.441	72.286	319.978	72.365	322.516	72.448	325.057	72.536	327.599	72.629	330.144	72.727	332.691	72.829	335.240	72.936	337.790	73.048	340.343	73.165	342.898	73.286	345.455	73.412	348.013	73.543	500	
400	262.080	58.104	264.624	58.201	267.172	58.305	269.722	58.416	272.274	58.532	274.829	58.654	277.387	58.781	279.947	58.916	282.509	59.055	285.074	59.201	287.641	59.352	290.211	59.510	292.782	59.673	400	100 (P)*
360	239.945	52.454	242.495	52.563	245.047	52.678	247.602	52.801	250.160	52.929	252.721	53.065	255.284	53.207	257.850	53.356	260.418	53.511	262.990	53.673	265.563	53.841	268.140	54.016	270.719	54.197	360	
350	234.413	51.044	236.964	51.156	239.517	51.275	242.074	51.401	244.633	51.534	247.196	51.673	249.760	51.819	252.328	51.972	254.898	52.132	257.471	52.298	260.047	52.471	262.625	52.651	265.206	52.838	350	
300	206.761	44.022	209.320	44.152	211.882	44.291	214.447	44.438	217.015	44.592	219.587	44.755	222.161	44.925	224.739	45.104	227.320	45.289	229.903	45.483	232.490	45.685	235.079	45.895	237.672	46.113	300	
250	179.134	37.057	181.703	37.214	184.276	37.380	186.853	37.556	189.433	37.741	192.017	37.936	194.604	38.140	197.195	38.354	199.790	38.577	202.387	38.809	204.988	39.051	207.593	39.302	210.200	39.563	250	80 (P)*
230	168.093	34.295	170.667	34.466	173.246	34.647	175.828	34.838	178.415	-35.039	181.005	35.251	183.599	35.472	186.196	35.705	188.798	35.947	191.402	36.199	194.011	36.462	196.622	36.735	199.237	37.018	230	
200	151.546	30.193	154.131	30.389	156.720	30.597	159.313	30.816	161.910	31.047	164.511	31.290	167.117	31.545	169.726	31.812	172.340	32.090	174.957	32.380	177.578	32.681	180.202	32.994	182.830	33.319	200	
170	135.027	26.160	137.623	26.390	140.225	26.634	142.832	26.892	145.443	27.164	148.059	27.449	150.679	27.748	153.303	28.061	155.932	28.388	158.565	28.728	161.201	29.081	163.841	29.449	166.485	29.830	170	
155	126.781	24.182	129.385	24.434	131.995	24.702	134.610	24.984	137.229	25.282	139.854	25.595	142.483	25.922	145.116	26.265	147.754	26.622	150.395	26.994	153.041	27.382	155.691	27.784	158.344	28.200	155	65 (P)*
125	110.331	20.349	112.955	20.681	115.585	20.992	118.220	21.341	120.860	21.709	123.506	22.095	126.156	22.499	128.811	22.922	131.470	23.362	134.133	23.821	136.800	24.298	139.470	24.793	142.144	25.306	125	
100	96.688	17.367	99.334	17.755	101.986	18.166	104.644	18.600	107.306	19.057	109.974	19.536	112.646	20.038	115.322	20.562	118.001	21.108	120.685	21.676	123.371	22.266	126.060	22.878	128.751	23.511	100	
90	91.257	16.266	93.913	16.696	96.576	17.151	99.243	17.632	101.916	18.137	104.593	18.667	107.274	19.222	109.959	19.801	112.647	20.404	115.338	21.032	118.031	21.683	120.726	22.357	123.422	23.055	90	50 (P)
80	85.845	15.246	88.513	15.728	91.186	16.238	93.865	16.775	96.548	17.341	99.234	17.934	101.924	18.553	104.617	19.200	107.312	19.873	110.008	20.573	112.706	21.298	115.404	22.049	118.102	22.826	80	50 (H)**
70	80.457	14.340	83.137	14.888	85.822	15.467	88.511	16.077	91.203	16.718	93.898	17.389	96.594	18.090	99.292	18.821	101.990	19.582	104.688	20.371	107.385	21.189	110.080	22.034	112.773	22.907	70	
60	75.098	13.503	77.789	14.236	80.484	14.905	83.181	15.609	85.878	16.347	88.577	17.120	91.274	17.925	93.969	18.764	96.662	19.635	99.352	20.538	102.036	21.471	104.716	22.435	107.388	23.428	60	40 (P)*
55	72.429	13.324	75.125	14.011	77.823	14.735	80.521	15.497	83.218	16.295	85.914	17.129	88.607	17.999	91.296	18.903	93.980	19.840	96.658	20.811	99.329	21.814	101.991	22.848	104.643	23.912	55	
50	69.767	13.128	72.465	13.877	75.163	14.666	77.859	15.495	80.552	16.362	83.241	17.268	85.924	18.211	88.600	19.190	91.268	20.203	93.926	21.251	96.573	22.332	99.207	23.445	101.829	24.588	50	40 (H)**
45	67.107	13.038	69.803	13.861	72.497	14.726	75.185	15.634	77.867	16.583	80.541	17.571	83.205	18.599	85.858	19.663	88.498	20.763	91.123	21.898	93.732	23.066	96.323	24.266	98.896	25.497	45	35 (P)*
40	54.442	13.092	57.130	14.090	59.810	14.927	62.481	15.927	65.141	17.001	67.785	18.096	70.416	19.210	73.028	20.372	75.621	21.570	78.192	22.802							40	30 (H)**
35	61.753	13.333	64.420	14.350	67.072	15.414	69.708	16.524	72.324	17.678	74.918	18.874															35	
33	60.663	13.500	63.315	14.564	65.950	15.677	68.563	16.837	71.153	18.039																	33	30 (P)*
30	58.998	13.842	61.620	14.986	64.215	16.178																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 59 Degrees

$\Delta = 59°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	1421.932	372.393	1424.434	372.396	1426.936	372.400	1429.438	372.406	1431.942	372.412	1434.445	372.419	1436.949	372.427	1439.454	372.436	1441.959	372.447	1444.464	372.457	1446.970	372.469	1449.476	372.482	1451.983	372.496	2500	
2200	1252.201	327.707	1254.703	327.710	1257.205	327.715	1259.708	327.721	1262.212	327.729	1264.716	327.737	1267.220	327.746	1269.725	327.756	1272.231	327.768	1274.737	327.780	1277.244	327.794	1279.751	327.808	1282.259	327.824	2200	
2000	1139.047	297.916	1141.549	297.920	1144.052	297.926	1146.555	297.932	1149.059	297.940	1151.563	297.949	1154.068	297.959	1156.573	297.970	1159.080	297.983	1161.586	297.997	1164.094	298.012	1166.602	298.028	1169.110	298.045	2000	
1800	1025.893	268.125	1028.395	268.130	1030.898	268.136	1033.401	268.144	1035.906	268.152	1038.411	268.162	1040.916	268.174	1043.422	268.186	1045.929	268.200	1048.437	268.215	1050.945	268.232	1053.453	268.250	1055.963	268.269	1800	
1500	856.162	223.440	858.665	223.446	861.168	223.453	863.672	223.462	866.177	223.472	868.683	223.484	871.190	223.498	873.697	223.513	876.205	223.530	878.714	223.548	881.224	223.568	883.734	223.590	886.246	223.613	1500	
1200	686.431	178.755	688.934	178.762	691.439	178.771	693.944	178.782	696.450	178.795	698.958	178.810	701.466	178.827	703.975	178.846	706.485	178.867	708.996	178.890	711.509	178.915	714.022	178.942	716.536	178.971	1200	
1000	573.277	148.966	575.781	148.974	578.287	148.985	580.793	148.999	583.301	149.014	585.810	149.032	588.319	149.052	590.831	149.075	593.343	149.100	595.856	149.128	598.370	149.157	600.886	149.190	603.403	149.225	1000	
900	516.701	134.072	519.205	134.081	521.711	134.093	524.218	134.108	526.727	134.125	529.237	134.145	531.747	124.167	534.260	134.193	536.773	134.221	539.288	134.251	541.804	134.284	544.322	134.320	546.840	134.359	900	
800	460.124	119.178	462.629	119.188	465.136	119.202	467.644	119.218	470.154	119.238	472.664	119.260	475.177	119.285	477.690	119.314	480.206	119.345	482.722	119.380	485.240	119.417	487.760	119.458	490.281	119.501	800	
700	403.548	104.284	406.054	104.296	408.561	104.311	411.071	104.330	413.582	104.353	416.094	104.378	418.608	104.407	421.124	104.439	423.641	104.476	426.160	104.515	428.680	104.558	431.203	104.604	433.726	104.653	700	100 (P)*
600	346.972	89.391	349.479	89.405	351.988	89.423	354.498	89.445	357.011	89.471	359.525	89.501	362.042	89.535	364.560	89.573	367.080	89.615	369.602	89.660	372.126	89.710	374.652	89.764	377.179	89.822	600	
500	290.397	74.499	292.905	74.516	295.415	74.537	297.928	74.564	300.443	74.595	302.960	74.631	305.480	74.671	308.002	74.717	310.526	74.767	313.052	74.823	315.581	74.882	318.111	74.947	320.644	75.016	500	
400	233.822	59.609	236.332	59.630	238.845	59.657	241.361	59.690	243.880	59.729	246.402	59.774	248.926	59.824	251.453	59.881	253.983	59.944	256.515	60.013	259.051	60.088	261.589	60.168	264.129	60.255	400	
360	211.193	53.654	213.704	53.677	216.218	53.707	218.736	53.744	221.257	53.787	223.781	53.837	226.308	53.893	228.838	53.956	231.371	54.026	233.907	54.103	236.446	54.186	238.988	54.275	241.533	54.372	360	
325	205.535	52.165	208.047	52.189	210.562	52.220	213.080	52.258	215.601	52.302	218.126	52.353	220.653	52.411	223.184	52.476	225.718	52.548	228.255	52.627	230.795	52.712	233.338	52.804	235.885	52.904	325	
300	177.249	44.722	179.763	44.750	182.280	44.786	184.801	44.830	187.326	44.882	189.854	44.942	192.387	45.010	194.922	45.085	197.461	45.169	200.004	45.261	202.551	45.361	205.101	45.468	207.654	45.584	300	80 (P)*
250	148.964	37.282	151.480	37.315	154.001	37.358	156.526	37.411	159.056	37.473	161.590	37.545	164.128	37.626	166.670	37.717	169.217	37.818	171.768	37.928	174.323	38.047	176.882	38.177	179.445	38.315	250	
230	137.650	34.307	140.168	34.343	142.690	34.390	145.218	34.447	147.750	34.515	150.286	34.593	152.828	34.681	155.374	34.780	157.924	34.889	160.479	35.009	163.039	35.138	165.602	35.279	168.170	35.429	230	
200	120.681	29.845	123.201	29.887	125.726	29.941	128.258	30.006	130.794	30.084	133.336	30.174	135.883	30.276	138.436	30.389	140.993	30.515	143.556	30.652	146.123	30.801	148.696	30.963	151.273	31.136	200	65 (P)*
170	103.712	23.386	106.238	25.435	108.766	25.498	111.302	25.576	113.845	25.667	116.394	25.773	118.949	25.892	121.510	26.026	124.076	26.173	126.649	26.335	129.227	26.511	131.810	26.700	134.399	26.904	170	
155	95.228	23.138	97.754	23.212	100.287	23.281	102.827	23.366	105.373	23.466	107.927	23.582	110.487	23.713	113.053	23.866	115.625	24.021	118.204	24.198	120.789	24.391	123.379	24.599	125.975	24.822	155	
125	78.283	18.706	80.795	18.773	83.335	18.859	85.84	18.964	88.441	19.088	91.006	19.232	93.579	19.394	96.159	19.576	98.747	19.776	101.342	19.995	103.943	20.234	106.552	20.491	109.167	20.767	125	
100	64.126	15.003	66.668	15.087	69.218	15.195	71.778	15.326	74.343	15.481	76.927	15.660	79.516	15.863	82.113	16.090	84.719	16.340	87.333	16.613	89.955	16.911	92.585	17.231	95.221	17.573	100	
90	58.477	13.526	61.020	13.619	63.575	13.738	66.141	13.884	68.718	14.057	71.305	14.256	73.902	14.481	76.508	14.732	79.124	15.010	81.748	15.313	84.380	15.643	87.020	15.998	89.668	16.380	90	50 (P)*
80	52.826	12.051	55.374	12.156	57.936	12.290	60.509	12.454	63.094	12.648	65.691	12.872	68.298	13.125	70.915	13.407	73.541	13.719	76.177	14.060	78.821	14.430	81.474	14.829	84.133	15.256	80	50 (H)**
70	47.177	10.581	49.722	10.700	52.301	10.854	54.884	11.041	57.479	11.263	60.087	11.518	62.706	11.807	65.336	12.129	67.976	12.484	70.626	12.875	73.284	13.304	75.950	13.748	78.623	14.235	70	
60	41.531	9.117	44.094	9.256	46.673	9.435	49.268	9.654	51.877	9.912	54.499	10.209	57.133	10.545	59.779	10.920	62.435	11.333	65.100	11.784	67.774	12.273	70.455	12.800	73.143	13.363	60	40 (P)*
55	38.709	8.388	41.278	8.540	43.863	8.736	46.465	8.974	49.082	9.255	51.712	9.579	54.355	9.945	57.010	10.353	59.675	10.802	62.349	11.293	65.031	11.825	67.720	12.396	70.415	13.008	55	
50	35.889	7.663	38.464	7.830	41.057	8.045	43.667	8.307	46.292	8.616	48.932	8.971	51.585	9.373	54.250	9.820	56.925	10.313	59.608	10.851	62.298	11.433	64.995	12.058	67.696	12.727	50	40 (H)**
45	33.071	6.942	35.652	7.128	38.254	7.366	40.874	7.652	43.510	7.999	46.161	8.393	48.825	8.838	51.500	9.339	54.185	9.879	56.877	10.475	59.575	11.115	62.278	11.805	64.993	12.541	45	35 (P)**
40	30.255	6.227	32.845	6.436	35.457	6.704	38.089	7.030	40.737	7.414	43.400	7.856	46.076	8.355	48.762	8.909	51.456	9.518	54.157	10.181	56.861	10.897	59.567	11.665	62.272	12.483	40	35 (H) 30 (P)*
35	27.442	5.521	30.044	5.759	32.668	6.064	35.313	6.436	37.975	6.874	40.651	7.377	43.340	7.943	46.036	8.571	48.739	9.261	51.444	10.010	54.150	10.818	56.852	11.681	59.549	12.599	35	
33	26.318	5.241	28.925	5.494	31.555	5.818	34.206	6.212	36.874	6.675	39.556	7.206	42.249	7.805	44.949	8.469	47.654	9.197	50.360	9.987	53.063	10.837	55.761	11.745	58.451	12.710	33	
30	24.634	4.827	27.249	5.104	29.889	5.460	32.550	5.892	35.228	6.400	37.918	6.982	40.617	7.636	43.322	8.361	46.028	9.154	48.730	10.013	51.427	10.935	54.112	11.919	56.784	12.960	30	30 (H)**
25	21.837	4.153	24.466	4.485	27.125	4.910	29.804	5.425	32.497	6.029	35.200	6.719	37.905	7.491	40.609	8.344	43.304	9.273	45.986	10.274	48.649	11.343	51.288	12.477	53.899	13.670	25	
23	20.716	3.893	23.357	4.253	26.025	4.713	28.711	5.271	31.410	5.924	34.115	6.668	36.820	7.500	39.517	8.415	42.200	9.410	44.863	10.480	47.500	11.619	50.105	12.822			23	25 (P)*
20	19.044	3.515	21.700	3.928	24.381	4.454	27.078	5.091	29.783	5.832	32.487	6.675	35.181	7.612	37.856	8.640	40.505	9.750	43.119	10.936							20	25 (H)**
15	16.275	2.946	18.959	3.491	21.661	4.180	24.365	5.006	27.056	5.959	29.719	7.029	32.339	8.202													15	20 (P)*
14	15.725	2.847	18.415	3.429	21.119	4.163	23.820	5.040	26.499	6.048	29.141	7.175															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 59 Degrees

$\Delta = 59^0$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	1454.490	372.511	1456.998	372.527	1459.506	372.543	1462.015	372.561	1464.524	372.580	1467.033	372.600	1469.543	372.620	1472.054	372.642	1474.565	372.664	1477.076	372.688	1479.588	372.712	1482.100	372.737	1484.613	372.764	2500	
2200	1284.767	327.841	1287.275	327.859	1289.784	327.878	1292.294	327.898	1294.805	327.919	1297.316	327.942	1299.827	327.965	1302.339	327.990	1304.851	328.015	1307.364	328.042	1309.878	328.070	1312.392	328.098	1314.906	328.128	2200	
2000	1171.619	298.064	1174.129	298.084	1176.639	298.104	1179.149	298.127	1181.661	298.150	1184.173	298.175	1186.685	298.200	1189.198	298.227	1191.712	298.255	1194.226	298.285	1196.741	298.315	1199.256	298.347	1201.772	298.380	2000	
1800	1058.473	268.290	1060.984	268.312	1063.495	268.335	1066.007	268.360	1068.520	268.385	1071.032	268.413	1073.546	268.441	1076.061	268.471	1078.576	268.502	1081.092	268.535	1083.608	268.569	1086.125	268.604	1088.643	268.641	1800	
1500	888.758	223.637	891.271	223.664	893.784	223.692	896.299	223.721	898.813	223.752	901.329	223.785	903.846	223.819	906.363	223.855	908.881	223.893	911.400	223.932	913.919	223.972	916.440	224.014	918.961	224.059	1500	
1200	719.051	179.002	721.567	179.035	724.083	179.070	726.601	179.106	729.120	179.145	731.640	179.186	734.160	179.229	736.682	179.274	739.205	179.321	741.728	179.370	744.252	179.420	746.777	179.473	749.304	179.528	1200	
1000	605.921	149.262	608.440	149.301	610.960	149.343	613.481	149.387	616.004	149.434	618.527	149.483	621.052	149.535	623.577	149.588	626.104	149.645	628.632	149.703	631.161	149.764	633.691	149.828	636.222	149.893	1000	
900	549.360	134.400	551.881	134.444	554.403	134.491	556.927	134.540	559.452	134.592	561.978	134.646	564.505	134.703	567.033	134.763	569.563	134.826	572.094	134.891	574.626	134.958	577.159	135.029	579.694	135.102	900	
800	492.803	119.547	495.327	119.596	497.852	119.649	500.378	119.704	502.906	119.763	505.435	119.824	507.966	119.888	510.497	119.956	513.031	120.026	515.565	120.099	518.101	120.175	520.638	120.255	523.177	120.337	800	
700	436.251	104.706	438.779	104.763	441.307	104.823	443.837	104.886	446.369	104.953	448.902	105.022	451.437	105.096	453.973	105.173	456.511	105.253	459.050	105.337	461.591	105.424	464.133	105.515	466.677	105.609	700	
600	379.700	89.884	382.240	89.950	384.773	90.020	387.308	90.093	389.844	90.171	392.383	90.253	394.923	90.338	397.465	90.428	400.009	90.522	402.554	90.619	405.102	90.721	407.650	90.827	410.201	90.936	600	
500	323.179	75.090	325.716	75.169	328.256	75.253	330.797	75.342	333.341	75.435	335.886	75.533	338.434	75.635	340.984	75.743	343.536	75.856	346.090	75.973	348.646	76.095	351.204	76.222	353.764	76.353	500	
400	266.673	60.348	269.219	60.446	271.767	60.551	274.318	60.662	276.872	60.778	279.428	60.901	281.987	61.029	284.548	61.164	287.112	61.304	289.678	61.451	292.247	61.603	294.818	61.761	297.391	61.926	400	
360	244.080	54.475	246.631	54.584	249.185	54.700	251.741	54.823	254.300	54.953	256.862	55.089	259.427	55.232	261.994	55.381	264.564	55.537	267.137	55.699	269.713	55.869	272.291	56.044	274.872	56.227	360	100 (P)*
350	238.434	53.099	240.986	53.122	243.541	53.241	246.099	53.368	248.659	53.501	251.223	53.641	253.789	53.788	256.358	53.942	258.930	54.102	261.505	54.269	264.083	54.443	266.663	54.624	269.245	54.812	350	
300	210.211	45.707	212.770	45.839	215.334	45.978	217.901	46.125	220.470	46.281	223.043	46.444	225.620	46.615	228.199	46.794	230.782	46.981	233.367	47.176	235.956	47.379	238.547	47.590	241.142	47.808	300	
250	182.012	38.463	184.583	38.621	187.157	38.788	189.736	38.965	192.318	39.151	194.904	39.347	197.493	39.552	200.086	39.767	202.683	39.991	205.283	40.224	207.887	40.467	210.493	40.720	213.104	40.982	250	
230	170.743	35.590	173.319	35.762	175.899	35.943	178.484	36.135	181.072	36.338	183.664	36.550	186.261	36.773	188.860	37.006	191.464	37.250	194.071	37.503	196.682	37.767	199.296	38.042	201.914	38.326	230	80 (P)*
200	153.854	31.321	156.441	31.518	159.032	31.726	161.627	31.947	164.226	32.179	166.830	32.424	169.438	32.680	172.051	32.947	174.667	33.227	177.287	33.518	179.911	33.821	182.538	34.136	185.170	34.462	200	
170	136.993	27.121	139.593	27.352	142.197	27.598	144.806	27.857	147.420	28.130	150.038	28.417	152.662	28.717	155.289	29.031	157.921	29.360	160.557	29.701	163.197	30.057	165.841	30.426	168.489	30.809	170	
155	128.577	25.060	131.184	25.314	133.797	25.582	136.414	25.866	139.037	26.165	141.664	26.479	144.297	26.809	146.933	27.153	149.573	27.512	152.220	27.886	154.870	28.275	157.523	28.679	160.181	29.098	155	65 (P)*
125	111.788	21.062	114.415	21.375	117.048	21.707	119.687	22.058	122.331	22.427	124.980	22.815	127.635	23.222	130.294	23.646	132.957	24.089	135.625	24.550	138.297	25.030	140.972	25.527	143.651	26.042	125	
100	97.865	17.942	100.515	18.332	103.171	18.745	105.833	19.181	108.500	19.640	111.172	20.122	113.849	20.626	116.530	21.153	119.216	21.701	121.905	22.272	124.597	22.865	127.292	23.480	129.990	24.116	100	
90	92.322	16.786	94.983	17.219	97.650	17.676	100.322	18.159	103.000	18.667	105.683	19.200	108.369	19.757	111.060	20.339	113.754	20.945	116.451	21.576	119.151	22.230	121.852	22.908	124.556	23.609	90	50 (P)
80	86.800	15.712	89.473	16.197	92.151	16.709	94.835	17.250	97.524	17.818	100.216	18.413	102.912	19.036	105.612	19.686	108.313	20.363	111.017	21.065	113.722	21.793	116.427	22.549	119.133	23.336	80	50 (H)**
70	81.303	14.753	83.989	15.304	86.679	15.885	89.374	16.499	92.073	17.143	94.774	17.817	97.478	18.522	100.183	19.257	102.888	20.027	105.594	20.814	108.299	21.635	111.003	22.485	113.704	23.363	70	
60	75.836	13.963	78.534	14.600	81.235	15.222	83.939	15.979	86.644	16.721	89.350	17.597	92.055	18.307	94.759	19.150	97.461	20.025	100.159	20.932	102.853	21.870	105.542	22.839	108.225	23.837	60	40 (P)*
55	73.114	13.659	75.817	14.349	78.522	15.077	81.228	15.842	83.933	16.644	86.637	17.483	89.339	18.356	92.037	19.265	94.731	20.207	97.418	21.183	100.099	22.190	102.771	23.229	105.435	24.299	55	
50	70.400	13.437	73.105	14.190	75.811	14.983	78.515	15.816	81.217	16.688	83.915	17.598	86.608	18.545	89.294	19.529	91.972	20.547	94.640	21.600	97.298	22.686	99.944	23.805	102.577	24.954	50	40 (H)**
45	67.689	13.323	70.394	14.149	73.096	15.019	75.793	15.931	78.485	16.884	81.169	17.878	83.843	18.910	86.506	19.980	89.157	21.086	91.793	22.226	94.414	23.400	97.018	24.606	99.603	25.842	45	35 (P)*
40	64.974	13.350	67.671	14.265	70.361	15.226	73.042	16.232	75.712	17.280	78.368	18.370	81.010	19.500	83.633	20.668	86.238	21.872	88.822	23.110							40	30 (H)**
35	62.237	13.570	64.915	14.591	67.578	15.661	70.225	16.777	72.852	17.937	75.458	19.138															35	
33	61.129	13.728	63.792	14.797	66.438	15.916	69.063	17.081	71.665	18.289																	33	30 (P)*
30	59.438	14.037	62.071	15.206	64.678	16.404																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 60 Degrees

$\Delta = 60°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1450.876	388.753	1453.378	386.758	1455.880	386.763	1458.383	386.768	1460.886	386.774	1463.389	386.781	1465.893	386.790	1468.398	386.799	1470.903	386.809	1473.408	386.820	1475.914	386.832	1478.421	386.845	1480.928	386.859	2500	
2200	1277.671	340.345	1280.173	340.349	1282.676	340.354	1285.179	340.360	1287.682	340.367	1290.187	340.375	1292.691	340.385	1295.196	340.395	1297.702	340.407	1300.208	340.419	1302.715	340.433	1305.222	340.448	1307.730	340.464	2200	
2000	1162.202	309.406	1164.704	309.410	1167.207	309.416	1169.710	309.422	1172.214	309.430	1174.719	309.439	1177.223	309.449	1179.729	309.461	1182.235	309.473	1184.742	309.487	1187.250	309.502	1189.758	309.518	1192.266	309.536	2000	
1800	1046.732	278.466	1049.233	278.471	1051.738	278.477	1054.241	278.484	1056.746	278.493	1059.250	278.503	1061.756	278.515	1064.262	278.527	1066.769	278.542	1069.277	278.557	1071.785	278.573	1074.294	278.592	1076.804	278.611	1800	
1600	873.528	232.058	876.031	232.063	878.534	232.070	881.039	232.079	883.544	232.090	886.050	232.102	888.556	232.115	891.064	232.130	893.573	232.147	896.082	232.166	898.592	232.186	901.102	232.208	903.614	232.231	1600	
1200	700.324	185.649	702.827	185.656	705.332	185.666	707.837	185.677	710.344	185.689	712.851	185.705	715.360	185.721	717.869	185.741	720.380	185.761	722.891	185.785	725.403	185.810	727.917	185.837	730.431	185.866	1200	
1000	584.855	154.711	587.359	154.719	589.865	154.730	592.371	154.744	594.879	154.759	597.388	154.777	599.898	154.798	602.409	154.821	604.922	154.846	607.435	154.873	609.950	154.904	612.466	154.936	614.983	154.971	1000	
900	527.121	139.242	529.625	139.252	532.131	139.264	534.638	139.279	537.147	139.296	539.657	139.316	542.168	139.339	544.681	139.364	547.195	139.392	549.710	139.423	552.226	139.456	554.744	139.492	557.263	139.531	900	
800	469.386	123.774	471.892	123.784	474.398	123.798	476.906	123.814	479.416	123.834	481.927	123.856	484.440	123.882	486.954	123.910	489.469	123.942	491.986	123.977	494.505	124.014	497.025	124.055	499.546	124.099	800	100 (P)*
700	411.652	108.306	414.158	108.318	416.666	108.333	419.175	108.352	421.687	108.375	424.199	108.400	426.714	108.429	429.229	108.462	431.747	108.498	434.267	108.538	436.787	108.581	439.310	108.627	441.834	108.677	700	
600	353.919	92.838	356.426	92.852	358.935	92.870	361.446	92.892	363.958	92.918	366.473	92.948	368.990	92.983	371.509	93.021	374.029	93.062	376.552	93.109	379.076	93.159	381.602	93.213	384.130	93.271	600	
500	296.186	77.372	298.694	77.389	301.205	77.410	303.718	77.437	306.233	77.468	308.751	77.504	311.271	77.545	313.793	77.591	316.318	77.641	318.844	77.697	321.373	77.757	323.905	77.822	326.438	77.891	500	
480	238.453	61.907	240.964	61.928	243.477	61.955	245.993	61.988	248.512	62.028	251.034	62.073	253.559	62.124	256.087	62.181	258.617	62.244	261.151	62.313	263.687	62.388	266.226	62.469	268.767	62.556	480	
460	215.361	55.722	217.872	55.746	220.387	55.776	222.905	55.813	225.426	55.856	227.951	55.906	230.478	55.963	233.009	56.026	235.543	56.096	238.079	56.173	240.619	56.257	243.162	56.347	245.708	56.444	460	
440	209.588	54.176	212.100	54.200	214.615	54.231	217.133	54.269	219.655	54.313	222.180	54.365	224.708	54.423	227.240	54.489	229.775	54.561	232.312	54.640	234.853	54.726	237.397	54.818	239.944	54.918	440	
420	180.723	46.446	183.237	46.474	185.754	46.510	188.276	46.554	190.801	46.607	193.330	46.667	195.863	46.735	198.400	46.811	200.940	46.895	203.483	46.987	206.031	47.087	208.582	47.196	211.136	47.312	420	80 (P)*
400	151.859	38.718	154.375	38.752	156.896	38.795	159.422	38.848	161.952	38.911	164.487	38.983	167.026	39.065	169.570	39.156	172.117	39.257	174.669	39.367	177.225	39.488	179.786	39.617	182.350	39.757	400	
380	140.314	35.628	142.832	35.665	145.355	35.712	147.882	35.769	150.415	35.837	152.953	35.916	155.495	36.005	158.042	36.104	160.594	36.214	163.150	36.334	165.710	36.464	168.275	36.605	170.845	36.757	380	
360	122.997	30.994	125.517	31.036	128.043	31.090	130.575	31.157	133.113	31.235	135.656	31.325	138.204	31.427	140.757	31.541	143.316	31.667	145.880	31.805	148.449	31.955	151.023	32.118	153.602	32.292	360	
340	105.681	26.363	108.205	26.412	110.736	26.476	113.273	26.554	115.817	26.646	118.367	26.752	120.923	26.872	123.485	27.006	126.053	27.154	128.627	27.317	131.207	27.493	133.792	27.684	136.383	27.888	340	65 (P)*
320	97.024	24.048	99.550	24.103	102.083	24.173	104.624	24.258	107.172	24.359	109.726	24.475	112.287	24.607	114.855	24.754	117.429	24.916	120.010	25.094	122.596	25.288	125.189	25.497	127.787	25.721	320	
300	89.288	19.424	82.244	19.491	84.785	19.578	87.335	19.684	89.893	19.809	92.459	19.953	95.034	20.116	97.616	20.298	100.206	20.500	102.803	20.720	105.407	20.960	108.018	21.218	110.636	21.496	300	
280	83.288	15.578	67.828	15.662	70.379	15.771	72.940	15.903	75.511	16.059	78.093	16.239	80.683	16.443	83.283	16.670	85.892	16.922	88.508	17.197	91.133	17.495	93.766	17.817	96.406	18.163	280	
260	59.320	14.043	62.064	14.137	64.620	14.257	67.188	14.404	69.766	14.577	72.355	14.777	74.955	15.003	77.564	15.256	80.182	15.535	82.809	15.840	85.445	16.171	88.088	16.528	90.740	16.911	260	50 (P)*
240	53.753	12.511	56.303	12.616	58.866	12.752	61.441	12.917	64.028	13.111	66.626	13.336	69.236	13.590	71.856	13.874	74.486	14.188	77.125	14.530	79.773	14.902	82.429	15.303	85.093	15.732	240	50 (H)**
220	47.989	10.984	50.545	11.104	53.116	11.258	55.700	11.447	58.298	11.669	60.908	11.926	63.531	12.216	66.164	12.540	68.807	12.897	71.461	13.287	74.123	13.711	76.794	14.167	79.472	14.656	220	
200	42.227	9.462	44.792	9.602	47.373	9.782	49.970	10.002	52.581	10.281	55.206	10.560	57.844	10.898	60.493	11.274	63.153	11.690	65.823	12.143	68.502	12.635	71.189	13.164	73.882	13.730	200	40 (P)*
180	39.348	8.705	41.918	8.858	44.506	9.054	47.110	9.294	49.729	9.576	52.363	9.902	55.010	10.269	57.668	10.679	60.338	11.131	63.017	11.624	65.705	12.159	68.400	12.733	71.100	13.348	180	
160	36.470	7.951	39.046	8.119	41.642	8.335	44.254	8.598	46.883	8.909	49.527	9.266	52.184	9.670	54.853	10.119	57.532	10.615	60.221	11.155	62.917	11.740	65.620	12.368	68.328	13.040	160	40 (H)**
140	33.594	7.202	36.178	7.388	38.782	7.628	41.405	7.920	44.044	8.264	46.699	8.660	49.367	9.107	52.048	9.605	54.738	10.153	57.436	10.750	60.141	11.396	62.850	12.089	65.563	12.829	140	35 (P)*
120	30.720	6.458	33.313	6.668	35.928	6.937	38.563	7.265	41.215	7.651	43.882	8.095	46.563	8.596	49.255	9.153	51.955	9.766	54.668	10.432	57.374	11.157	60.087	11.923	62.800	12.745	120	35 (H) 30 (P)*
100	27.850	5.723	30.454	5.963	33.082	6.270	35.730	6.644	38.397	7.083	41.078	7.588	43.772	8.157	46.475	8.789	49.185	9.482	51.898	10.235	54.611	11.047	57.323	11.915	60.029	12.837	100	
80	26.703	5.433	29.313	5.686	31.946	6.012	34.601	6.408	37.274	6.873	39.961	7.407	42.660	8.009	45.367	8.676	48.079	9.408	50.793	10.202	53.505	11.056	56.212	11.969	58.912	12.938	80	
60	24.985	5.001	27.603	5.280	30.247	5.637	32.912	6.072	35.594	6.582	38.291	7.167	40.997	7.824	43.709	8.552	46.422	9.349	49.134	10.213	51.839	11.140	54.535	12.128	57.217	13.175	60	30 (H)**
50	24.127	4.289	24.763	4.633	27.426	5.060	30.117	5.577	32.810	6.184	35.519	6.877	38.235	7.654	40.945	8.511	43.649	9.444	46.341	10.450	49.015	11.525	51.666	12.664	54.288	13.863	50	
40	20.987	4.027	23.632	4.389	26.304	4.852	28.996	5.412	31.702	6.068	34.414	6.816	37.127	7.652	39.833	8.573	42.527	9.572	45.200	10.647	47.849	11.792	50.466	13.001			40	25 (P)*
30	19.281	3.633	21.941	4.048	24.627	4.577	27.331	5.216	30.044	5.962	32.756	6.908	35.472	7.921	38.189	9.082	40.905	10.492	43.621	11.971							30	25 (H)**
15	16.456	3.036	19.145	3.583	21.854	4.276	24.567	5.106	27.267	6.064	29.941	7.139	32.573	8.318													15	20 (P)*
14	15.894	2.931	18.590	3.516	21.302	4.254	24.011	5.135	26.701	6.148	29.354	7.281															14	20 (H)**

*P= Plain & Rolling Terrain **H= Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 60 Degrees

$\Delta = 60°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1483.435	386.874	1485.943	386.890	1488.451	386.906	1490.960	386.924	1493.469	386.943	1495.979	386.963	1498.489	386.984	1501.000	387.005	1503.511	387.028	1506.023	387.052	1508.535	387.076	1511.048	387.101	1513.561	387.128	2500	
2200	1310.239	340.480	1312.748	340.499	1315.257	340.518	1317.767	340.538	1320.278	340.559	1322.789	340.582	1325.300	340.605	1327.813	340.630	1330.325	340.656	1332.838	340.682	1335.352	340.710	1337.866	340.739	1340.381	340.769	2200	
2000	1194.776	309.554	1197.285	309.574	1199.796	309.595	1202.307	309.618	1204.818	309.641	1207.331	309.666	1209.843	309.692	1212.357	309.719	1214.871	309.747	1217.385	309.776	1219.900	309.807	1222.416	309.839	1224.932	309.872	2000	
1800	1079.314	278.632	1081.825	278.654	1084.336	278.677	1086.849	278.702	1089.362	278.728	1091.875	278.755	1094.389	278.784	1096.904	278.814	1099.419	278.845	1101.936	278.878	1104.452	278.912	1106.969	278.948	1109.488	278.984*	1800	
1500	906.126	232.256	908.639	232.282	911.153	232.310	913.668	232.340	916.183	232.371	918.699	232.404	921.216	232.439	923.734	232.475	926.252	232.512	928.771	232.552	931.291	232.593	933.812	232.635	936.333	232.679	1500	
1200	732.946	185.893	735.463	185.930	737.980	185.965	740.498	186.002	743.017	186.041	745.537	186.082	748.058	186.125	750.580	186.171	753.103	186.218	755.627	186.267	758.152	186.318	760.678	186.371	763.205	186.426	1200	
1000	617.501	155.008	620.021	155.048	622.542	155.090	625.063	155.133	627.586	155.181	630.110	155.230	632.635	155.282	635.161	155.337	637.689	155.393	640.217	155.452	642.747	155.513	645.278	155.577	647.809	155.643	1000	
900	559.783	139.573	562.303	139.616	564.827	139.663	567.351	139.713	569.877	139.765	572.403	139.819	574.931	139.877	577.460	139.937	579.991	140.000	582.522	140.065	585.055	140.134	587.589	140.204	590.124	140.278	900	
800	502.069	124.145	504.593	124.195	507.119	124.247	509.645	124.303	512.174	124.362	514.704	124.423	517.235	124.488	519.767	124.555	522.301	124.626	524.837	124.700	527.373	124.776	529.911	124.856	532.451	124.939	800	
700	444.360	108.739	446.888	108.787	449.417	108.847	451.948	108.910	454.480	108.978	457.014	109.048	459.549	109.122	462.086	109.199	464.625	109.280	467.165	109.364	469.707	109.451	472.250	109.542	474.795	109.637	700	
650	386.660	93.333	389.192	93.399	391.726	93.470	394.261	93.544	396.799	93.622	399.338	93.704	401.879	93.790	404.422	93.880	406.967	93.975	409.513	94.073	412.062	94.175	414.612	94.281	417.163	94.391	650	
600	328.974	77.960	331.512	78.045	334.052	78.129	336.595	78.219	339.139	78.312	341.686	78.411	344.234	78.514	346.785	78.622	349.338	78.735	351.894	78.853	354.451	78.975	357.010	79.103	359.571	79.235	600	
500	271.311	62.690	273.858	62.749	276.408	62.854	278.960	62.965	281.515	63.082	284.072	63.205	286.632	63.334	289.195	63.470	291.760	63.611	294.328	63.758	296.898	63.911	299.471	64.070	302.046	64.235	500	
450	248.257	56.547	250.809	56.657	253.363	56.774	255.921	56.897	258.481	57.028	261.045	57.165	263.611	57.308	266.180	57.458	268.752	57.615	271.326	57.778	273.903	57.948	276.483	58.125	279.066	58.308	450	100 (P)*
350	242.495	55.024	245.048	55.138	247.604	55.258	250.163	55.385	252.725	55.519	255.290	55.659	257.858	57.807	260.429	55.961	263.002	56.122	265.579	56.291	268.158	56.466	270.740	56.647	273.324	56.836	350	
300	213.694	47.436	216.255	47.568	218.820	47.708	221.388	47.856	223.960	48.012	226.534	48.176	229.112	48.348	231.694	48.528	234.278	48.716	236.866	48.912	239.456	49.116	242.050	49.328	244.647	49.547	300	
250	184.919	39.906	187.491	40.004	190.067	40.232	192.648	40.410	195.232	40.597	197.820	40.793	200.411	41.000	203.006	41.215	205.605	41.441	208.208	41.675	210.813	41.920	213.423	42.173	216.036	42.437	250	
230	173.419	36.918	175.997	37.091	178.579	37.273	181.165	37.466	183.756	37.669	186.350	37.883	188.949	38.107	191.551	38.341	194.157	38.586	196.767	38.841	199.380	39.106	201.997	39.382	204.618	39.667	230	
200	156.185	32.477	158.774	32.673	161.367	32.885	163.964	33.107	166.566	33.340	169.172	33.586	171.783	33.843	174.398	34.112	177.017	34.393	179.640	34.686	182.267	34.990	184.898	35.307	187.532	35.635	200	80 (P)*
170	138.980	28.107	141.581	28.339	144.188	28.586	146.800	28.846	149.416	29.120	152.038	29.409	154.664	29.711	157.295	30.027	159.930	30.356	162.569	30.700	165.213	31.057	167.861	31.428	170.512	31.813	170	
155	130.391	25.960	133.001	26.215	135.616	26.485	138.237	26.771	140.863	27.071	143.493	27.387	146.129	27.718	148.769	28.064	151.414	28.425	154.063	28.801	156.717	29.192	159.374	29.597	162.036	30.018	155	65 (P)*
125	113.260	21.792	115.890	22.107	118.527	22.441	121.169	22.792	123.817	23.165	126.470	23.554	129.128	23.963	131.792	24.390	134.459	24.835	137.132	25.298	139.808	25.780	142.489	26.280	145.173	26.798	125	
100	99.053	18.532	101.707	18.924	104.367	19.339	107.034	19.777	109.705	20.239	112.383	20.723	115.065	21.229	117.751	21.758	120.442	22.310	123.137	22.884	125.835	23.479	128.536	24.097	131.240	24.737	100	
90	93.398	17.320	96.063	17.755	98.735	18.215	101.412	18.700	104.095	19.210	106.783	19.746	109.475	20.306	112.172	20.891	114.872	21.500	117.575	22.133	120.282	22.791	122.990	23.472	125.700	24.177	90	50 (P)
80	87.764	16.191	90.442	16.678	93.126	17.183	95.815	17.736	98.509	18.307	101.208	18.905	103.910	19.531	106.616	20.184	109.325	20.864	112.035	21.571	114.747	22.303	117.461	23.062	120.174	23.846	80	50 (H)**
70	82.157	15.177	84.848	15.730	87.545	16.315	90.246	16.931	92.951	17.578	95.659	18.256	98.370	18.965	101.082	19.703	103.796	20.471	106.509	21.268	109.223	22.094	111.935	22.948	114.645	23.829	70	
60	76.581	14.333	79.285	14.973	81.993	15.648	84.704	16.359	87.417	17.105	90.131	17.885	92.844	18.699	95.557	19.546	98.267	20.425	100.975	21.337	103.678	22.280	106.377	23.253	109.070	24.256	60	40 (P)*
55	73.806	14.002	76.516	14.696	79.228	15.427	81.941	16.196	84.655	17.003	87.368	17.845	90.078	18.723	92.786	19.636	95.489	20.583	98.186	21.563	100.877	22.576	103.560	23.621	106.234	24.696	55	
50	71.039	13.755	73.752	14.511	76.466	15.308	79.179	16.145	81.889	17.021	84.596	17.936	87.299	18.888	89.994	19.876	92.681	20.900	95.362	21.958	98.030	23.050	100.687	24.174	103.332	25.328	50	40 (H)**
45	68.276	13.614	70.990	14.445	73.700	15.319	76.407	16.236	79.108	17.194	81.802	18.192	84.487	19.230	87.161	20.305	89.823	21.416	92.471	22.562	95.103	23.742	97.719	24.954	100.316	26.196	45	35 (P)*
40	65.511	13.617	68.218	14.536	70.918	15.502	73.609	16.513	76.289	17.567	78.957	18.662	81.609	19.798	84.245	20.971	86.861	22.181	89.457	23.425							40	30 (H)**
35	62.727	13.813	65.414	14.839	68.088	15.914	70.746	17.036	73.386	18.201	76.004	19.409															35	
33	61.660	13.961	64.274	15.036	66.931	16.160	69.567	17.331	72.181	18.546																	33	30 (P)*
30	59.882	14.277	62.526	15.432	65.146	16.636																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 61 Degrees

$\Delta = 61°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=30 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	1480.113	401.484	1482.615	401.488	1485.117	401.492	1487.619	401.498	1490.123	401.504	1492.626	401.511	1495.130	401.519	1497.635	401.529	1500.140	401.539	1502.646	401.550	1505.152	401.562	1507.658	401.575	1510.166	401.589	2500	
2300	1303.400	353.307	1305.902	353.311	1308.404	353.316	1310.907	353.323	1313.411	353.330	1315.915	353.338	1318.420	353.347	1320.925	353.357	1323.431	353.369	1325.937	353.382	1328.444	353.396	1330.952	353.410	1333.460	353.426	2300	
2000	1185.591	321.189	1188.093	321.194	1190.596	321.199	1193.100	321.206	1195.604	321.214	1198.108	321.223	1200.613	321.233	1203.119	321.245	1205.625	321.257	1208.132	321.271	1210.640	321.286	1213.148	321.302	1215.657	321.320	2000	
1800	1067.783	289.072	1070.285	289.076	1072.788	289.083	1075.292	289.090	1077.796	289.099	1080.302	289.109	1082.807	289.120	1085.313	289.133	1087.821	289.147	1090.328	289.162	1092.837	289.179	1095.346	289.198	1097.856	289.217	1800	
1500	891.070	240.896	893.573	240.901	896.076	240.908	898.581	240.917	901.086	240.927	903.593	240.940	906.099	240.953	908.607	240.969	911.115	240.986	913.625	241.004	916.135	241.024	918.646	241.046	921.158	241.070	1500	
1200	714.358	192.719	716.861	192.727	719.366	192.736	721.872	192.747	724.378	192.760	726.885	192.775	729.394	192.792	731.904	192.811	734.414	192.832	736.926	192.855	739.439	192.881	741.952	192.908	744.467	192.937	1200	
1000	596.550	160.603	599.054	160.611	601.560	160.622	604.066	160.636	606.574	160.651	609.083	160.669	611.594	160.690	614.105	160.713	616.618	160.738	619.132	160.766	621.647	160.796	624.163	160.829	626.681	160.864	1000	
900	537.646	144.545	540.151	144.554	542.657	144.567	545.164	144.581	547.673	144.599	550.183	144.619	552.695	144.642	555.207	144.667	557.722	144.696	560.237	144.726	562.753	144.760	565.272	144.796	567.791	144.835	900	
800	478.742	128.487	481.248	128.498	483.754	128.511	486.263	128.528	488.773	128.548	491.284	128.570	493.797	128.596	496.311	128.625	498.827	128.656	501.344	128.691	503.863	128.729	506.384	128.770	508.905	128.814	800	
700	419.839	112.430	422.345	112.442	424.853	112.458	427.362	112.477	429.874	112.499	432.386	112.525	434.901	112.554	437.417	112.587	439.936	112.623	442.456	112.663	444.977	112.706	447.500	112.753	450.024	112.803	700	100 (P)*
600	360.936	96.373	363.443	96.387	365.952	96.406	368.463	96.428	370.976	96.454	373.491	96.484	376.008	96.519	378.527	96.557	381.048	96.599	383.571	96.646	386.096	96.696	388.623	96.750	391.152	96.809	600	
500	302.033	80.318	304.542	80.335	307.052	80.356	309.566	80.383	312.082	80.415	314.600	80.451	317.120	80.492	319.643	80.538	322.168	80.588	324.695	80.644	327.225	80.705	329.757	80.770	332.291	80.840	500	
400	243.131	64.264	245.642	64.285	248.156	64.312	250.672	64.346	253.192	64.385	255.714	64.430	258.240	64.482	260.768	64.539	263.299	64.602	265.833	64.672	268.370	64.747	270.909	64.829	273.452	64.917	400	
360	219.571	57.844	222.083	57.867	224.598	57.897	227.116	57.934	229.638	57.978	232.163	58.028	234.691	58.085	237.222	58.149	239.757	58.219	242.294	58.297	244.835	58.380	247.379	58.471	249.926	58.569	360	
325	213.681	56.238	216.193	56.262	218.709	56.294	221.228	56.333	223.750	56.376	226.275	56.428	228.804	56.487	231.337	56.553	233.872	56.625	236.411	56.705	238.952	56.791	241.497	56.884	244.045	56.984	325	
300	184.232	48.214	186.746	48.242	189.264	48.279	191.786	48.323	194.312	48.375	196.841	48.436	199.373	48.504	201.912	48.581	204.453	48.665	206.998	48.758	209.546	48.858	212.098	48.967	214.654	49.084	300	80 (P)*
250	154.783	40.192	157.300	40.225	159.821	40.269	162.348	40.322	164.878	40.385	167.414	40.458	169.954	40.540	172.498	40.631	175.047	40.733	177.600	40.844	180.157	40.965	182.719	41.095	185.285	41.235	250	
230	143.004	36.983	145.522	37.020	148.046	37.068	150.574	37.125	153.107	37.194	155.646	37.272	158.189	37.362	160.737	37.462	163.290	37.572	165.847	37.693	168.409	37.824	170.976	37.966	173.547	38.118	230	
200	125.336	32.173	127.857	32.215	130.384	32.270	132.916	32.336	135.455	32.415	137.998	32.505	140.548	32.608	143.102	32.723	145.662	32.849	148.228	32.988	150.798	33.139	153.374	33.302	155.954	33.477	200	
170	107.670	27.365	110.194	27.414	112.725	27.478	115.264	27.557	117.808	27.649	120.359	27.756	122.917	27.876	125.480	28.011	128.050	28.160	130.626	28.324	133.207	28.501	135.794	28.692	138.387	28.898	170	65 (P)*
155	98.837	24.962	101.364	25.017	103.898	25.087	106.440	25.172	108.988	25.274	111.544	25.391	114.106	25.523	116.676	25.671	119.251	25.834	121.834	26.013	124.422	26.208	127.017	26.418	129.618	26.643	155	
125	81.174	20.161	83.707	20.229	86.249	20.316	88.800	20.422	91.359	20.548	93.927	20.692	96.503	20.857	99.087	21.040	101.679	21.242	104.278	21.464	106.885	21.705	109.499	21.964	112.119	22.243	125	
100	64.438	15.188	66.999	16.233	69.561	16.361	74.114	16.494	76.687	16.631	79.270	16.832	81.863	17.037	84.465	17.265	87.076	17.518	89.695	17.795	92.323	18.095	94.959	18.418	97.603	18.766	100	50 (P)*
90	60.574	14.574	63.119	14.668	65.676	14.789	68.245	14.936	70.826	15.111	73.417	15.311	76.018	15.539	78.630	15.793	81.251	16.073	83.881	16.380	86.520	16.713	89.167	17.072	91.822	17.457	90	
80	54.690	12.983	57.241	13.089	59.805	13.225	62.382	13.391	64.971	13.587	67.572	13.812	70.184	14.068	72.807	14.353	75.440	14.668	78.082	15.013	80.734	15.386	83.394	15.789	86.063	16.221	80	50 (H)**
70	48.899	11.397	51.366	11.518	53.939	11.673	56.525	11.862	59.125	12.086	61.738	12.344	64.363	12.633	67.000	12.961	69.647	13.320	72.304	13.712	74.971	14.138	77.648	14.598	80.335	15.089	70	
60	42.931	9.817	45.497	9.958	48.080	10.138	50.679	10.359	53.293	10.620	55.921	10.920	58.562	11.259	61.215	11.638	63.879	12.055	66.554	12.511	69.238	13.005	71.930	13.537	74.629	14.106	60	40 (P)*
55	39.993	9.030	42.565	9.184	45.154	9.381	47.761	9.622	50.383	9.906	53.020	10.233	55.671	10.602	58.334	11.014	61.008	11.469	63.692	11.964	66.385	12.501	69.085	13.079	71.793	13.697	55	
50	37.057	8.247	39.635	8.416	42.232	8.633	44.848	8.897	47.480	9.209	50.127	9.568	52.788	9.974	55.462	10.426	58.146	10.924	60.840	11.467	63.543	12.055	66.252	12.687	68.966	13.362	50	40 (H)**
45	34.123	7.468	36.708	7.656	39.315	7.896	41.941	8.190	44.584	8.536	47.243	8.934	49.915	9.383	52.601	9.884	55.296	10.434	58.001	11.034	60.712	11.683	63.428	12.380	66.148	13.124	45	35 (P)*
40	31.191	6.695	33.786	6.906	36.403	7.172	39.041	7.506	41.697	7.892	44.369	8.341	47.055	8.844	49.752	9.404	52.459	10.020	55.173	10.689	57.892	11.413	60.613	12.188	63.335	13.015	40	35 (H) 30 (P)*
35	28.263	5.931	30.869	6.172	33.500	6.480	36.152	6.856	38.823	7.298	41.510	7.806	44.209	8.378	46.919	9.013	49.635	9.709	52.356	10.466	55.078	11.282	57.798	12.154	60.513	13.082	35	
33	27.093	5.629	29.704	5.884	32.341	6.211	35.000	6.609	37.678	7.077	40.371	7.614	43.076	8.218	45.789	8.889	48.509	9.624	51.231	10.422	53.951	11.281	56.668	12.198	59.377	13.172	33	
30	25.339	5.180	27.960	5.460	30.607	5.819	33.277	6.256	35.965	6.769	38.667	7.356	41.380	8.017	44.099	8.749	46.821	9.550	49.541	10.418	52.256	11.350	54.961	12.343	57.654	13.395	30	30 (H)**
25	22.424	4.449	25.063	4.784	27.731	5.213	30.420	5.737	33.126	6.343	35.842	7.060	38.564	7.820	41.284	8.682	43.998	9.670	46.700	10.631	49.385	11.711	52.047	12.856	54.682	14.082	25	
23	21.261	4.165	23.909	4.529	26.580	4.964	29.284	5.557	31.996	6.217	34.716	6.968	37.438	7.899	40.153	8.734	42.856	9.739	45.541	10.819	48.201	11.969	50.831	13.185			23	25 (P)*
20	19.521	3.753	22.185	4.170	24.876	4.702	27.587	5.345	30.306	6.094	33.027	6.945	35.740	7.893	38.456	8.930	41.107	10.051	43.746	11.249							20	25 (H)**
15	16.638	3.128	19.334	3.678	22.049	4.375	24.770	5.209	27.491	6.172	30.165	7.252	32.809	8.437													15	20 (P)*
14	16.066	3.018	18.768	3.605	21.487	4.347	24.205	5.233	26.905	6.251	29.570	7.389															14	20 (H)**

*P – Plain & Rolling Terrain **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 61 Degrees

$\Delta = 61°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1512.673	401.604	1515.181	401.620	1517.689	401.637	1520.195	401.655	1522.708	401.674	1525.218	401.694	1527.728	401.714	1530.240	401.736	1532.751	401.758	1535.263	401.782	1537.775	401.807	1540.288	401.833	1542.801	401.859	2500	
2200	1335.968	353.443	1338.477	353.461	1340.987	353.480	1343.497	353.501	1346.008	353.522	1348.519	353.545	1351.031	353.569	1353.544	353.593	1356.056	353.619	1358.570	353.646	1361.084	353.674	1363.598	353.703	1366.114	353.733	2200	
2000	1218.167	321.339	1220.677	321.359	1223.187	321.380	1225.698	321.402	1228.210	321.426	1230.722	321.451	1233.236	321.477	1235.749	321.504	1238.263	321.532	1240.778	321.562	1243.294	321.593	1245.810	321.625	1248.326	321.658	2000	
1800	1100.366	289.238	1102.877	289.260	1105.389	289.283	1107.902	289.308	1110.415	289.334	1112.928	289.362	1115.443	289.391	1117.958	289.421	1120.474	289.452	1122.990	289.485	1125.507	289.520	1128.025	289.555	1130.543	289.592	1800	
1500	923.670	241.094	926.183	241.121	928.698	241.149	931.213	241.179	933.728	241.210	936.244	241.243	938.762	241.278	941.280	241.314	943.799	241.352	946.318	241.392	948.839	241.433	951.360	241.476	953.882	241.520	1500	
1200	746.982	192.968	749.499	193.002	752.017	193.037	754.535	193.074	757.055	193.114	759.575	193.155	762.097	193.198	764.619	193.243	767.143	193.291	769.667	193.340	772.192	193.391	774.719	193.445	777.246	193.500	1200	
1000	629.199	160.902	631.719	160.941	634.240	160.984	636.762	161.028	639.286	161.076	641.810	161.125	644.335	161.177	646.863	161.232	649.390	161.288	651.919	161.347	654.450	161.409	656.981	161.473	659.514	161.540	1000	
900	570.312	144.877	572.834	144.921	575.357	144.968	577.881	145.018	580.407	145.070	582.935	145.125	585.463	145.183	587.992	145.243	590.524	145.306	593.056	145.372	595.589	145.441	598.124	145.512	600.660	145.586	900	
800	511.428	128.860	513.953	128.910	516.479	128.963	519.007	129.019	521.536	129.078	524.066	129.140	526.598	129.205	529.131	129.273	531.666	129.344	534.202	129.418	536.739	129.495	539.278	129.575	541.819	129.658	800	
700	452.551	112.856	455.079	112.913	457.609	112.974	460.140	113.038	462.673	113.105	465.208	113.176	467.744	113.250	470.282	113.328	472.821	113.409	475.362	113.493	477.905	113.582	480.449	113.673	482.994	113.768	700	
600	393.682	96.871	396.215	96.938	398.749	97.008	401.286	97.083	403.824	97.161	406.364	97.244	408.906	97.330	411.450	97.421	413.995	97.516	416.543	97.614	419.092	97.717	421.643	97.823	424.196	97.934	600	
500	334.828	80.915	337.366	80.994	339.907	81.079	342.451	81.169	344.996	81.263	347.544	81.362	350.094	81.466	352.646	81.574	355.200	81.688	357.756	81.806	360.314	81.929	362.875	82.058	365.438	82.190	500	
400	275.997	65.010	278.545	65.110	281.095	65.216	283.649	65.327	286.205	65.445	288.764	65.569	291.325	65.699	293.889	65.835	296.456	65.976	299.025	66.124	301.596	66.278	304.171	66.438	306.748	66.604	400	
360	252.476	56.673	255.028	58.783	257.584	58.901	260.143	59.025	262.705	59.155	265.270	59.293	267.837	59.437	270.408	59.588	272.981	59.746	275.557	59.910	278.136	60.081	280.718	60.258	283.302	60.442	360	100 (P)*
350	246.597	57.091	249.151	57.205	251.708	57.326	254.269	57.453	256.832	57.588	259.399	57.729	261.968	57.877	264.540	58.033	267.115	58.195	269.694	58.364	272.274	58.540	274.858	58.722	277.445	58.911	350	
300	217.213	49.209	219.725	49.341	222.342	49.482	224.911	49.631	227.484	49.788	230.061	49.953	232.640	50.126	235.224	50.307	237.810	50.495	240.399	50.692	242.992	50.897	245.588	51.110	248.187	51.331	300	
250	187.835	41.383	190.429	41.544	193.007	41.713	195.589	41.892	198.173	42.080	200.765	42.277	203.358	42.485	205.956	42.701	208.557	42.928	211.162	43.164	213.770	43.409	216.382	43.664	218.997	43.929	250	
230	176.122	38.280	178.702	38.453	181.286	38.637	183.874	38.831	186.467	39.035	189.063	39.250	191.664	39.475	194.269	39.710	196.877	39.957	199.490	40.213	202.106	40.479	204.726	40.756	207.349	41.043	230	80 (P)*
210	158.340	33.664	161.130	33.863	163.725	34.073	166.325	34.296	168.929	34.531	171.538	34.778	174.151	35.036	176.769	35.307	179.391	35.589	182.017	35.883	184.647	36.189	187.281	36.507	189.919	36.837	210	
190	140.986	29.118	143.590	29.351	146.199	29.599	148.814	29.861	151.433	30.136	154.057	30.426	156.687	30.730	159.320	31.047	161.959	31.379	164.602	31.724	167.249	32.083	169.901	32.456	172.556	32.842	190	
175	132.224	26.884	134.837	27.140	137.454	27.411	140.078	27.698	142.707	28.000	145.340	28.317	147.979	28.650	150.623	28.998	153.271	29.360	155.924	29.738	158.582	30.131	161.244	30.539	163.910	30.962	175	65 (P)*
160	114.746	22.541	117.380	22.858	120.020	23.193	122.666	23.548	125.317	23.921	127.974	24.312	130.637	24.723	133.305	25.152	135.977	25.599	138.654	26.065	141.335	26.549	144.021	27.052	146.711	27.572	160	
150	100.254	19.136	102.912	19.531	105.576	19.948	108.247	20.389	110.923	20.852	113.605	21.339	116.292	21.848	118.984	22.380	121.681	22.934	124.381	23.511	127.085	24.109	129.793	24.730	132.504	25.373	150	
140	94.485	17.868	97.155	18.305	99.831	18.767	102.513	19.255	105.201	19.768	107.894	20.306	110.592	20.869	113.295	21.457	116.001	22.069	118.711	22.706	121.424	23.367	124.139	24.051	126.857	24.760	140	50 (P)
130	88.739	16.682	91.421	17.171	94.110	17.689	96.805	18.235	99.505	18.808	102.210	19.410	104.918	20.039	107.631	20.696	110.346	21.379	113.064	22.089	115.783	22.825	118.504	23.588	121.226	24.376	130	30 (H)**
120	83.020	15.612	85.716	16.167	88.419	16.755	91.126	17.375	93.838	18.025	96.553	13.707	99.271	19.419	101.991	20.161	104.712	20.932	107.434	21.733	110.155	22.563	112.876	23.422	115.595	24.308	120	
110	77.334	14.713	80.045	15.355	82.760	16.034	85.478	16.749	88.198	17.498	90.919	18.282	93.641	19.100	96.362	19.952	99.082	20.836	101.798	21.752	104.512	22.699	107.220	23.678	109.923	24.686	110	40 (P)*
100	74.505	14.335	77.222	15.061	79.941	15.787	82.662	16.560	85.384	17.370	88.105	18.217	90.825	19.099	93.542	20.017	96.254	20.969	98.961	21.954	101.662	22.972	104.356	24.022	107.041	25.102	100	
90	71.685	14.080	74.405	14.840	77.127	15.641	79.849	16.482	82.568	17.363	85.285	18.282	87.996	19.239	90.702	20.233	93.401	21.262	96.090	22.326	98.770	23.423	101.439	24.552	104.095	25.713	90	40 (H)**
85	68.870	13.913	71.592	14.748	74.311	15.627	77.027	16.548	79.738	17.511	82.442	18.515	85.137	19.557	87.822	20.638	90.495	21.755	93.155	22.907	95.800	24.093	98.428	25.311	101.037	26.559	85	35 (P)*
80	65.055	13.890	68.770	14.814	71.480	15.785	74.191	16.801	76.872	17.860	79.551	18.962	82.215	20.103	84.862	21.282	87.491	22.498	90.100	23.749	92.686	25.032					80	30 (H)**
75	63.221	14.062	65.919	15.094	68.604	16.174	71.273	17.301	73.924	18.473	76.555	19.686															75	
70	62.075	14.201	64.760	15.281	67.428	16.411	70.077	17.588	72.704	18.809																	70	25 (P)*
65	60.330	14.503	62.986	15.664	65.618	16.874																					65	30 (H)**
60																											60	
55																											55	
50																											50	25 (H)**
45																											45	20 (P)*
40																											40	
35																											35	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 62 Degrees

$\Delta = 62°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	1509.653	416.588	1512.135	416.592	1514.657	416.596	1517.160	416.601	1519.663	416.608	1522.167	416.615	1524.671	416.623	1527.176	416.633	1529.681	416.643	1532.187	416.654	1534.693	416.666	1537.200	416.679	1539.707	416.693	2500	
2200	1329.395	366.599	1331.897	366.603	1334.400	366.608	1336.903	366.614	1339.407	366.621	1341.911	366.629	1344.416	366.639	1346.921	366.649	1349.427	366.661	1351.933	366.673	1354.441	366.687	1356.948	366.702	1359.457	366.718	2200	
2000	1209.223	333.273	1211.726	333.277	1214.229	333.282	1216.732	333.289	1219.236	333.297	1221.741	333.306	1224.246	333.316	1226.752	333.328	1229.258	333.341	1231.766	333.355	1234.273	333.370	1236.782	333.386	1239.291	333.404	2000	
1800	1089.052	299.947	1091.554	299.951	1094.057	299.957	1096.561	299.965	1099.066	299.974	1101.571	299.984	1104.077	299.995	1106.583	300.008	1109.091	300.022	1111.598	300.038	1114.107	300.055	1116.616	300.073	1119.126	300.092	1800	
1500	908.794	249.958	911.297	249.964	913.801	249.971	916.305	249.979	918.811	249.990	921.317	250.002	923.824	250.016	926.332	250.301	928.841	250.048	931.350	250.067	933.861	250.087	936.372	250.109	938.884	250.133	1500	
1200	728.537	199.969	731.041	199.977	733.545	199.986	736.051	199.997	738.558	200.010	741.066	200.025	743.574	200.042	746.084	200.062	748.595	200.083	751.107	200.106	753.620	200.132	756.134	200.159	758.649	200.188	1200	
1000	608.366	166.645	610.870	166.653	613.376	166.664	615.883	166.677	618.391	166.693	620.900	166.711	623.411	166.732	625.922	166.755	628.435	166.781	630.949	166.809	633.465	166.839	635.981	166.872	638.500	166.907	1000	
900	548.281	149.982	550.785	149.992	553.292	150.004	555.799	150.019	558.308	150.036	560.819	150.057	563.330	150.080	565.841	150.105	568.358	150.134	570.873	150.165	573.390	150.198	575.909	150.235	578.429	150.274	900	
800	488.195	133.321	490.701	133.331	493.208	133.345	495.716	133.362	498.226	133.381	500.738	133.404	503.251	133.430	505.766	133.459	508.282	133.490	510.800	133.526	513.319	133.563	515.839	133.604	518.362	133.649	800	
700	428.110	116.693	430.617	116.671	433.124	116.687	435.634	116.706	438.146	116.729	440.659	116.755	443.174	116.784	445.691	116.817	448.209	116.854	450.729	116.894	453.251	116.937	455.775	116.984	458.300	117.034	700	100 (P)*
600	368.026	99.998	370.533	100.013	373.042	100.031	375.553	100.053	378.067	100.079	380.582	100.110	383.100	100.144	385.619	100.183	388.140	100.225	390.664	100.272	393.189	100.323	395.717	100.377	398.246	100.436	600	
500	307.941	83.339	310.450	83.356	312.961	83.377	315.475	83.404	317.991	83.436	320.509	83.472	323.030	83.514	325.553	83.560	328.079	83.611	330.607	83.667	333.137	83.728	335.670	83.793	338.205	83.864	500	
400	247.858	66.681	250.369	66.702	252.883	66.729	255.400	66.763	257.920	66.802	260.443	66.848	262.969	66.899	265.497	66.957	268.029	67.021	270.564	67.091	273.101	67.167	275.642	67.249	278.185	67.337	400	
360	223.825	60.019	226.337	60.042	228.853	60.073	231.371	60.110	233.894	60.154	236.419	60.204	238.948	60.261	241.480	60.326	244.015	60.396	246.553	60.474	249.095	60.558	251.639	60.649	254.187	60.747	360	
320	217.817	58.353	220.329	58.377	222.845	58.409	225.365	58.447	227.887	58492	230.413	58.544	232.943	58.603	235.476	58.669	238.012	58.742	240.551	58.822	243.094	58.908	245.640	59.002	248.189	59.103	320	80 (P)*
300	187.777	50.027	190.291	50.055	192.810	50.092	195.332	50.136	197.858	50.189	200.389	50.249	202.923	50.318	205.461	50.395	208.001	50.480	210.548	50.573	213.098	50.675	215.651	50.784	218.208	50.901	300	
250	157.737	41.702	160.255	41.736	162.777	41.780	165.303	41.833	167.835	41.896	170.371	41.969	172.912	42.052	175.457	42.144	178.007	42.246	180.561	42.358	183.120	42.479	185.683	42.611	188.250	42.751	250	
230	143.722	38.373	146.241	38.410	150.765	38.458	153.294	38.516	155.828	38.584	158.367	38.664	160.911	38.754	163.460	38.854	166.014	38.965	168.573	39.086	171.136	39.218	173.704	39.360	176.276	39.513	230	
200	127.700	33.381	130.221	33.424	132.749	33.479	135.282	33.545	137.821	33.624	140.366	33.715	142.916	33.819	145.472	33.934	148.033	34.061	150.600	34.201	153.172	34.353	155.749	34.516	158.331	34.692	200	65 (P)*
170	109.679	28.392	112.204	28.442	114.736	28.506	117.275	28.585	119.820	28.678	122.371	28.785	124.931	28.906	127.496	29.042	130.067	29.192	132.645	29.356	135.228	29.534	137.817	29.727	140.412	29.933	170	
155	100.669	25.899	103.197	25.954	105.732	26.024	108.274	26.110	110.824	26.212	113.381	26.330	115.944	26.463	118.515	26.612	121.093	26.776	123.677	26.956	126.267	27.151	128.864	27.362	131.467	27.589	155	
135	87.652	20.917	85.186	20.985	87.729	21.072	90.281	21.179	92.841	21.305	95.411	21.451	97.988	21.616	100.574	21.800	103.168	22.004	105.770	22.226	108.379	22.468	110.995	22.729	113.618	23.010	135	
120	67.641	16.773	70.183	16.858	72.726	16.967	75.300	17.100	77.875	17.258	80.459	17.440	83.054	17.646	85.659	17.876	88.272	18.130	90.895	18.408	93.526	18.709	96.165	19.035	98.812	19.384	120	
90	61.638	15.119	64.185	15.213	66.743	15.334	69.314	15.483	71.896	15.658	74.489	15.860	77.092	16.088	79.707	16.344	82.331	16.625	84.964	16.934	87.607	17.268	90.257	17.629	92.917	18.016	90	50 (P)*
80	55.637	13.467	58.189	13.574	60.754	13.710	63.333	13.877	65.924	14.074	68.527	14.301	71.142	14.558	73.767	14.844	76.404	15.161	79.050	15.507	81.705	15.883	84.370	16.288	87.042	16.722	80	50 (H)**
70	49.638	11.821	52.196	11.942	54.770	12.098	57.359	12.288	59.961	12.513	62.577	12.772	65.205	13.065	67.844	13.393	70.495	13.753	73.157	14.148	75.828	14.576	78.508	15.037	81.198	15.531	70	
60	43.642	10.180	46.209	10.322	48.784	10.504	51.395	10.726	54.012	10.987	56.643	11.289	59.287	11.630	61.944	12.011	64.613	12.430	67.292	12.889	69.981	13.385	72.678	13.920	75.383	14.492	60	40 (P)*
55	40.645	9.364	43.218	9.518	45.810	9.716	48.419	9.958	51.044	10.244	53.684	10.572	56.339	10.944	59.006	11.358	61.684	11.815	64.374	12.313	67.072	12.853	69.779	13.433	72.492	14.055	55	
50	37.650	8.550	40.230	8.720	42.829	8.938	45.447	9.204	48.083	9.517	50.733	9.878	53.399	10.286	56.077	10.741	58.766	11.241	61.466	11.787	64.175	12.378	66.890	13.013	69.611	13.692	50	40 (H)**
45	34.657	7.741	37.244	7.930	39.853	8.172	42.485	8.467	45.129	8.815	47.792	9.215	50.469	9.667	53.159	10.169	55.861	10.723	58.571	11.326	61.289	11.978	64.015	12.679	66.740	13.426	45	35 (P)*
40	31.666	6.938	34.267	7.150	36.884	7.422	39.525	7.754	42.185	8.144	44.861	8.592	47.552	9.099	50.255	9.661	52.968	10.280	55.689	10.953	58.415	11.680	61.144	12.460	63.874	13.290	40	35 (H) 30 (P)*
35	28.679	6.144	31.288	6.386	33.922	6.696	36.578	7.074	39.254	7.518	41.946	8.029	44.651	8.603	47.367	9.242	50.091	9.942	52.819	10.703	55.549	11.523	58.278	12.400	61.003	13.332	35	
33	27.486	5.839	30.100	6.086	32.741	6.415	35.403	6.815	38.086	7.285	40.784	7.825	43.495	8.431	46.216	9.107	48.943	9.846	51.673	10.648	54.402	11.511	57.128	12.434	59.847	13.413	33	
30	25.698	5.363	28.321	5.645	30.972	6.005	33.646	6.444	36.339	6.969	39.047	7.551	41.767	8.215	44.493	8.951	47.223	9.756	49.952	10.628	52.677	11.565	55.393	12.564	58.096	13.621	30	30 (H)**
25	22.724	4.802	25.367	4.939	28.039	5.170	30.737	5.493	33.455	6.006	36.189	7.207	38.898	7.991	41.622	8.857	44.351	9.806	47.083	10.816	49.759	11.902	52.433	13.051	55.080	14.265	25	
23	21.537	4.306	24.190	4.672	26.871	5.140	29.575	5.706	32.294	6.369	35.021	7.124	37.751	7.969	40.476	8.899	43.190	9.907	45.886	10.995	48.557	12.151	51.199	13.373			23	25 (P)*
20	19.782	3.877	22.431	4.296	25.128	4.831	27.845	5.477	30.572	6.230	33.302	7.085	36.024	8.038	38.738	9.085	41.442	10.209	44.094	11.417							20	25 (H)**
18	18.821	3.522	19.523	3.775	22.247	4.195	24.976	5.314	27.696	6.282	30.392	7.367	33.048	8.559													15	20 (P)*
14	16.239	3.106	18.947	3.697	21.674	4.442	24.401	5.533	27.111	6.852	29.788	8.300															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 62 Degrees

$\Delta = 62°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1542.215	416.708	1544.723	416.724	1547.231	416.741	1549.741	416.760	1552.250	416.779	1554.761	416.799	1557.271	416.819	1559.782	416.841	1562.294	416.864	1564.806	416.888	1567.319	416.913	1569.832	416.938	1572.345	416.965	2500	
2200	1361.965	366.735	1364.474	366.753	1366.984	366.773	1369.495	366.793	1372.006	366.815	1374.517	366.837	1377.029	366.861	1379.542	366.886	1382.055	366.912	1384.569	366.939	1387.083	366.967	1389.598	366.997	1392.113	367.027	2200	
2000	1241.800	333.423	1244.311	333.443	1246.821	333.464	1249.333	333.487	1251.845	333.510	1254.357	333.535	1256.871	333.562	1259.385	333.589	1261.899	333.617	1264.414	333.647	1266.930	333.678	1269.446	333.710	1271.963	333.741	2000	
1800	1121.637	300.113	1124.148	300.135	1126.660	300.159	1129.173	300.184	1131.687	300.210	1134.200	300.238	1136.715	300.267	1139.231	300.298	1141.747	300.329	1144.264	300.362	1146.781	300.397	1149.299	300.433	1151.818	300.470	1800	
1500	941.396	250.158	943.910	250.185	946.425	250.213	948.940	250.243	951.456	250.275	953.972	250.308	956.490	250.343	959.008	250.379	961.528	250.417	964.048	250.457	966.568	250.498	969.090	250.541	971.613	250.585	1500	
1200	761.165	200.219	763.682	200.233	766.199	200.288	768.718	200.326	771.238	200.365	773.759	200.407	776.281	200.450	778.804	200.496	781.328	200.544	783.853	200.593	786.379	200.645	788.906	200.698	791.433	200.754	1200	
1000	641.018	166.945	643.539	166.985	646.060	167.027	648.583	167.072	651.107	167.120	653.631	167.169	656.158	167.222	658.685	167.276	661.214	167.333	663.743	167.393	666.274	167.455	668.806	167.519	671.339	167.586	1000	
900	580.950	150.316	583.472	150.360	585.996	150.408	588.521	150.458	591.047	150.510	593.575	150.565	596.104	150.624	598.634	150.684	601.166	150.748	603.699	150.814	606.233	150.883	608.769	150.954	611.305	151.029	900	
800	520.885	133.696	523.410	133.746	525.937	133.799	528.465	133.855	530.995	133.914	533.526	133.977	536.058	134.042	538.592	134.110	541.127	134.180	543.664	134.256	546.203	134.333	548.742	134.414	551.284	134.498	800	
700	460.827	117.088	463.355	117.145	465.886	117.206	468.418	117.270	470.951	117.338	473.487	117.409	476.024	117.483	478.562	117.562	481.103	117.643	483.644	117.729	486.188	117.817	488.733	117.909	491.280	118.004	700	
600	400.771	100.499	403.311	100.565	405.846	100.636	408.383	100.711	410.922	100.790	413.463	100.873	416.006	100.960	418.550	101.051	421.097	101.146	423.645	101.246	426.196	101.349	428.748	101.456	431.302	101.567	600	
500	340.742	83.939	343.281	84.019	345.823	84.104	348.368	84.194	350.914	84.289	353.463	84.388	356.013	84.492	358.567	84.602	361.122	84.716	363.680	84.835	366.239	84.959	368.801	85.088	371.365	85.221	500	
400	280.731	67.431	283.280	67.531	285.832	67.637	288.386	67.750	290.944	67.868	293.504	67.992	296.066	68.123	298.632	68.260	301.200	68.402	303.771	68.551	306.344	68.705	308.920	68.866	311.498	69.033	400	
360	256.738	60.852	259.292	60.963	261.849	61.081	264.409	61.206	266.972	61.337	269.539	61.476	272.108	61.621	274.680	61.772	277.255	61.931	279.832	62.095	282.413	62.268	284.997	62.446	287.583	62.631	360	
350	250.741	59.210	253.297	59.325	255.855	59.446	258.417	59.574	260.982	59.710	263.550	59.852	266.121	60.001	268.695	60.157	271.271	60.320	273.851	60.489	276.434	60.666	279.020	60.850	281.608	61.040	350	
300	220.768	51.027	223.332	51.160	225.900	51.302	228.471	51.451	231.046	51.609	233.624	51.774	236.205	51.948	238.790	52.130	241.378	52.320	243.970	52.518	246.564	52.724	249.162	52.938	251.764	53.160	300	
250	190.821	42.902	193.397	43.062	195.977	43.231	198.561	43.411	201.149	43.600	203.740	43.799	206.336	44.007	208.936	44.225	211.539	44.453	214.146	44.690	216.757	44.937	219.372	45.193	221.990	45.459	250	
230	178.853	39.677	181.435	39.851	184.021	40.035	186.611	40.230	189.206	40.436	191.805	40.652	194.408	40.878	197.015	41.115	199.626	41.362	202.241	41.619	204.860	41.887	207.482	42.166	210.109	42.454	230	80 (P)*
200	160.919	34.880	163.511	35.080	166.108	35.292	168.710	35.516	171.317	35.752	173.928	36.000	176.544	36.260	179.165	36.532	181.789	36.815	184.418	37.111	187.051	37.419	189.689	37.738	192.330	38.070	200	
170	143.013	30.154	145.620	30.389	148.231	30.638	150.849	30.901	153.471	31.178	156.098	31.469	158.730	31.775	161.367	32.094	164.009	32.427	166.656	32.774	169.307	33.135	171.962	33.510	174.622	33.898	170	
155	134.076	27.831	136.691	28.088	139.312	28.361	141.938	28.649	144.570	28.953	147.207	29.272	149.849	29.606	152.496	29.955	155.148	30.320	157.805	30.700	160.467	31.095	163.133	31.505	165.803	31.930	155	65 (P)*
125	116.249	23.309	118.885	23.627	121.529	23.965	124.178	24.321	126.834	24.696	129.495	25.090	132.161	25.502	134.833	25.933	137.510	26.383	140.192	26.851	142.878	27.338	145.569	27.843	148.264	28.366	125	
100	101.467	19.757	104.129	20.153	106.797	20.572	109.472	21.015	112.154	21.481	114.841	21.970	117.533	22.482	120.230	23.017	122.932	23.574	125.639	24.154	128.349	24.756	131.063	25.380	133.780	26.026	100	
90	95.583	18.429	98.257	18.868	100.938	19.333	103.626	19.823	106.319	20.339	109.017	20.880	111.721	21.446	114.430	22.037	117.142	22.652	119.858	23.292	122.578	23.957	125.301	24.645	128.025	25.357	90	50 (P)
80	89.723	17.185	92.411	17.677	95.105	18.197	97.805	18.746	100.511	19.323	103.222	19.928	105.937	20.560	108.656	21.220	111.378	21.907	114.103	22.620	116.830	23.361	119.559	24.127	122.289	24.920	80	50 (H)**
70	83.891	16.057	86.594	16.616	89.302	17.207	92.016	17.829	94.734	18.483	97.456	19.168	100.181	19.884	102.909	20.630	105.638	21.406	108.368	22.211	111.098	23.045	113.827	23.908	116.556	24.799	70	
60	78.065	15.102	80.812	15.748	83.534	16.430	86.259	17.148	88.987	17.902	91.716	18.690	94.447	19.512	97.176	20.368	99.905	21.236	102.631	22.177	105.354	23.130	108.072	24.113	110.785	25.127	60	40 (P)*
55	75.211	14.717	77.935	15.416	80.662	16.155	83.391	16.932	86.121	17.747	88.851	18.598	91.579	19.485	94.305	20.407	97.027	21.364	99.745	22.355	102.456	23.378	105.160	24.433	107.856	25.519	55	
50	72.337	14.413	75.066	15.177	77.795	15.983	80.525	16.828	83.254	17.714	85.980	18.638	88.701	19.600	91.417	20.598	94.126	21.633	96.827	22.702	99.518	23.805	102.198	24.940	104.866	26.107	50	40 (H)**
45	69.470	14.220	72.200	15.059	74.929	15.942	77.654	16.869	80.375	17.837	83.089	18.845	85.795	19.893	88.491	20.980	91.175	22.102	93.846	23.260	96.503	24.452	99.143	25.677	101.766	26.932	45	35 (P)*
40	66.603	14.171	69.328	15.100	72.048	16.076	74.760	17.097	77.461	18.162	80.151	19.269	82.827	20.416	85.486	21.601	88.127	22.823	90.749	24.081							40	30 (H)**
35	63.721	14.317	66.429	15.354	69.125	16.440	71.806	17.573	74.469	18.751	77.112	19.971															35	
33	62.556	14.447	65.252	15.533	67.932	16.669	70.592	17.851	73.231	19.078																	33	30 (P)*
30	60.783	14.735	63.451	15.902	66.096	17.114																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 63 Degrees

$\Delta = 63°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1539.503	432.073	1542.005	432.077	1544.508	432.082	1547.010	432.087	1549.514	432.093	1552.017	432.101	1554.522	432.109	1557.027	432.118	1559.532	432.129	1562.038	432.140	1564.544	432.152	1567.051	432.165	1569.558	432.179	2500	
2200	1355.664	380.226	1358.166	380.230	1360.668	380.235	1363.171	380.241	1365.675	380.248	1368.179	380.257	1370.684	380.266	1373.190	380.277	1375.696	380.288	1378.202	380.301	1380.710	380.315	1383.218	380.330	1385.726	380.346	2200	
2000	1233.104	345.661	1235.606	345.665	1238.109	345.671	1240.612	345.677	1243.116	345.686	1245.621	345.695	1248.127	345.703	1250.633	345.716	1253.139	345.729	1255.646	345.743	1258.153	345.759	1260.663	345.775	1263.172	345.793	2000	
1800	1110.544	311.096	1113.046	311.101	1115.550	311.107	1118.053	311.114	1120.558	311.123	1123.063	311.133	1125.570	311.145	1128.076	311.158	1130.583	311.172	1133.092	311.187	1135.601	311.205	1138.110	311.223	1140.620	311.242	1800	
1500	926.705	259.249	929.208	259.255	931.711	259.262	934.216	259.271	936.721	259.281	939.228	259.294	941.735	259.307	944.243	259.323	946.752	259.340	949.261	259.359	951.772	259.379	954.283	259.401	956.796	259.425	1500	
1200	742.865	207.402	745.369	207.410	747.874	207.419	750.380	207.430	752.886	207.443	755.394	207.458	757.903	207.476	760.414	207.495	762.924	207.516	765.436	207.540	767.950	207.565	770.464	207.593	772.979	207.622	1200	
1000	620.306	172.839	622.811	172.847	625.316	172.858	627.823	172.872	630.332	172.887	632.841	172.906	635.352	172.927	637.864	172.950	640.377	172.976	642.891	173.003	645.407	173.034	647.924	173.067	650.442	173.103	1000	
900	559.027	155.557	561.532	155.567	564.038	155.579	566.546	155.594	569.055	155.611	571.565	155.632	574.077	155.655	576.591	155.681	579.105	155.709	581.621	155.740	584.139	155.774	586.658	155.811	589.178	155.851	900	
800	497.748	138.276	500.253	138.287	502.760	138.300	505.269	138.317	507.779	138.337	510.291	138.360	512.804	138.386	515.319	138.415	517.836	138.447	520.354	138.482	522.874	138.520	525.395	138.561	527.917	138.606	800	
700	436.469	120.995	438.975	121.008	441.483	121.023	443.993	121.042	446.505	121.065	449.018	121.091	451.533	121.121	454.051	121.154	456.569	121.190	459.090	121.231	461.612	121.274	464.136	121.322	466.662	121.372	700	100 (P)*
600	375.190	103.715	377.697	103.729	380.207	103.748	382.718	103.770	385.232	103.796	387.748	103.827	390.265	103.862	392.785	103.900	395.307	103.943	397.831	103.990	400.357	104.041	402.885	104.096	405.415	104.155	600	
500	313.912	86.436	316.420	86.453	318.932	86.475	321.446	86.502	323.962	86.533	326.481	86.570	329.002	86.612	331.526	86.658	334.052	86.709	336.580	86.766	339.111	86.827	341.645	86.893	344.180	86.964	500	
400	252.634	69.159	255.146	69.180	257.660	69.208	260.177	69.241	262.697	69.281	265.221	69.327	267.747	69.378	270.277	69.437	272.809	69.500	275.344	69.571	277.883	69.647	280.424	69.729	282.968	69.818	400	
360	228.124	62.249	230.636	62.272	233.152	62.303	235.671	62.340	238.194	62.384	240.719	62.435	243.249	62.493	245.781	62.557	248.317	62.629	250.856	62.707	253.399	62.791	255.945	62.883	258.493	62.981	360	
320	221.906	60.321	224.399	60.346	227.025	60.377	229.545	60.615	232.068	60.661	234.595	60.713	237.125	60.772	239.658	60.839	242.195	60.912	244.735	60.992	247.279	61.080	249.826	61.174	252.376	61.275	320	
300	191.359	51.885	193.874	51.914	196.393	51.950	198.915	51.995	201.442	52.048	203.973	52.109	206.508	52.178	209.047	52.255	211.590	52.341	214.136	52.434	216.687	52.536	219.241	52.646	221.799	52.764	300	80 (P)*
250	160.723	43.251	163.240	43.285	165.763	43.329	168.290	43.383	170.822	43.446	173.359	43.520	175.901	43.603	178.447	43.696	180.998	43.798	183.553	43.910	186.113	44.032	188.677	44.164	191.246	44.306	250	
230	148.469	39.798	150.988	39.835	153.512	39.883	156.042	39.942	158.577	40.010	161.117	40.090	163.662	40.180	166.212	40.281	168.767	40.393	171.327	40.515	173.891	40.647	176.461	40.791	179.035	40.944	230	
200	130.088	34.621	132.610	34.663	135.138	34.718	137.672	34.785	140.212	34.865	142.758	34.956	145.309	35.060	147.866	35.176	150.429	35.304	152.997	35.444	155.570	35.597	158.149	35.761	160.733	35.938	200	65 (P)*
170	111.709	29.445	114.235	29.496	116.768	29.560	119.307	29.639	121.854	29.733	124.407	29.840	126.967	29.962	129.533	30.099	132.106	30.249	134.685	30.414	137.270	30.594	139.862	30.787	142.459	30.995	170	
155	102.521	26.859	105.049	26.914	107.584	26.985	110.128	27.072	112.678	27.174	115.236	27.292	117.802	27.426	120.374	27.576	122.953	27.741	125.539	27.922	128.131	28.118	130.730	28.330	133.336	28.558	155	
125	84.145	21.691	86.680	21.760	89.224	21.848	91.777	21.955	94.339	22.082	96.910	22.228	99.489	22.394	102.077	22.579	104.673	22.784	107.276	23.008	109.888	23.251	112.507	23.514	115.133	23.795	125	
100	68.836	17.393	71.379	17.478	73.933	17.588	76.498	17.722	79.075	17.881	81.661	18.064	84.258	18.271	86.865	18.502	89.481	18.757	92.107	19.036	94.741	19.340	97.383	19.667	100.034	20.018	100	
90	62.714	15.677	65.261	15.772	67.821	15.894	70.393	16.043	72.977	16.219	75.572	16.422	78.178	16.652	80.795	16.908	83.422	17.192	86.059	17.501	88.704	17.838	91.359	18.201	94.022	18.590	90	50 (P)*
80	56.594	13.964	59.146	14.070	61.712	14.208	64.293	14.375	66.886	14.573	69.492	14.801	72.109	15.060	74.738	15.348	77.378	15.666	80.027	16.014	82.687	16.392	85.355	16.799	88.032	17.235	80	50 (H)**
70	50.475	12.255	53.035	12.377	55.610	12.534	58.201	12.725	60.805	12.951	63.424	13.212	66.055	13.505	68.698	13.835	71.353	14.198	74.018	14.595	76.693	15.025	79.378	15.488	82.077	15.983	70	
60	44.360	10.553	46.929	10.695	49.516	10.878	52.119	11.101	54.738	11.364	57.372	11.668	60.020	12.011	62.681	12.393	65.354	12.815	68.038	13.276	70.732	13.775	73.435	14.312	76.146	14.888	60	40 (P)*
55	41.304	9.705	43.878	9.861	46.472	10.060	49.084	10.303	51.712	10.590	54.355	10.920	57.014	11.294	59.685	11.710	62.368	12.169	65.063	12.670	67.767	13.213	70.479	13.797	73.199	14.421	55	
50	38.249	8.861	40.831	9.032	43.432	9.251	46.053	9.518	48.692	9.833	51.346	10.196	54.016	10.606	56.698	11.063	59.393	11.566	62.099	12.115	64.813	12.709	67.535	13.348	70.263	14.030	50	40 (H)**
45	35.197	8.021	37.786	8.211	40.398	8.454	43.029	8.751	45.680	9.100	48.347	9.503	51.029	9.957	53.724	10.462	56.431	11.019	59.148	11.625	61.872	12.281	64.603	12.985	67.338	13.736	45	35 (P)*
40	32.147	7.188	34.749	7.401	37.369	7.674	40.004	8.007	42.654	8.392	45.322	8.850	48.005	9.432	50.704	9.925	53.418	10.547	56.211	11.224	58.944	11.955	61.681	12.738	64.420	13.573	40	35 (H) 30 (P)*
35	29.100	6.363	31.712	6.606	34.349	6.918	37.009	7.297	39.689	7.744	42.386	8.257	45.097	8.835	47.820	9.477	50.551	10.181	53.287	10.946	56.025	11.770	58.763	12.651	61.497	13.588	35	
33	27.883	6.036	30.500	6.294	33.144	6.624	35.811	7.026	38.498	7.499	41.202	8.042	43.919	8.653	46.647	9.330	49.381	10.073	52.119	10.880	54.858	11.748	57.593	12.675	60.322	13.659	33	
30	26.059	5.551	28.686	5.834	31.341	6.197	34.019	6.638	36.717	7.156	39.432	7.750	42.158	8.418	44.892	9.158	47.630	9.967	50.368	10.844	53.102	11.786	55.828	12.790	58.542	13.853	30	30 (H)**
25	23.027	4.759	25.631	5.098	28.249	5.532	31.049	6.037	33.768	6.674	36.498	7.378	39.235	8.166	41.973	9.037	44.707	9.985	47.430	11.007	50.137	12.066	52.832	13.155	55.502	14.275	25	
23	21.817	4.451	24.473	4.819	27.159	5.289	29.868	5.858	32.594	6.525	35.330	7.284	38.068	8.133	40.803	9.068	43.527	10.084	46.234	11.176	48.917	12.338	51.571	13.566			23	25 (P)*
20	20.007	4.004	22.679	4.425	25.382	4.963	28.105	5.612	30.841	6.369	33.579	7.229	36.311	8.187	39.028	9.235	41.722	10.368	44.385	11.579							20	25 (H)**
15	17.010	3.319	19.716	3.875	22.446	4.579	25.184	5.422	27.914	6.395	30.621	7.486	33.289	8.664													15	20 (P)*
14	16.444	3.197	19.128	3.791	21.862	4.540	24.599	5.435	27.320	6.465	30.008	7.615															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 63 Degrees

Δ=63°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1572.066	432.194	1574.574	432.210	1577.083	432.228	1579.593	432.246	1582.103	432.265	1584.613	432.285	1587.124	432.306	1589.635	432.328	1592.147	432.351	1594.659	432.375	1597.172	432.400	1599.686	432.426	1602.199	432.452	2500	
2200	1388.235	380.363	1390.744	380.381	1393.254	380.401	1395.765	380.421	1398.276	380.443	1400.788	380.466	1403.300	380.490	1405.813	380.515	1408.327	380.541	1410.841	380.568	1413.355	380.596	1415.870	380.626	1418.386	380.656	2200	
2000	1265.682	345.812	1268.192	345.832	1270.703	345.853	1273.215	345.876	1275.728	345.900	1278.240	345.925	1280.754	345.951	1283.268	345.979	1285.783	346.007	1288.298	346.037	1290.814	346.068	1293.331	346.101	1295.848	346.134	2000	
1800	1143.131	311.264	1145.643	311.286	1148.155	311.310	1150.668	311.335	1153.181	311.361	1155.696	311.389	1158.211	311.418	1160.726	311.449	1163.243	311.481	1165.760	311.514	1168.278	311.549	1170.796	311.585	1173.315	311.622	1800	
1500	959.309	259.450	961.822	259.477	964.337	259.506	966.853	259.536	969.369	259.567	971.886	259.601	974.404	259.636	976.923	259.673	979.443	259.711	981.963	259.751	984.484	259.792	987.006	259.835	989.529	259.880	1500	
1200	775.495	207.654	778.013	207.687	780.531	207.723	783.050	207.761	785.570	207.801	788.092	207.842	790.614	207.886	793.137	207.932	795.662	207.980	798.187	208.030	800.714	208.081	803.241	208.135	805.770	208.191	1200	
1000	652.962	173.140	655.482	173.181	658.004	173.223	660.527	173.269	663.052	173.316	665.577	173.366	668.104	173.419	670.632	173.474	673.161	173.531	675.691	173.591	678.223	173.654	680.755	173.718	683.289	173.785	1000	
900	591.699	155.893	594.222	155.937	596.747	155.985	599.272	156.035	601.799	156.088	604.327	156.143	606.857	156.202	609.388	156.263	611.920	156.327	614.454	156.393	616.989	156.462	619.525	156.534	622.062	156.609	900	
800	530.441	138.653	532.967	138.703	535.494	138.757	538.023	138.813	540.553	138.873	543.085	138.936	545.618	139.001	548.152	139.070	550.688	139.142	553.226	139.217	555.765	139.294	558.306	139.375	560.848	139.459	800	
700	469.189	121.426	471.719	121.484	474.250	121.545	476.782	121.609	479.316	121.677	481.853	121.749	484.390	121.824	486.930	121.903	489.471	121.984	492.013	122.070	494.558	122.159	497.104	122.251	499.652	122.347	700	
600	407.947	104.218	410.481	104.285	413.016	104.356	415.554	104.432	418.094	104.511	420.636	104.594	423.180	104.682	425.725	104.773	428.273	104.869	430.822	104.969	433.374	105.073	435.927	105.180	438.482	105.292	600	
500	346.719	87.039	349.259	87.120	351.802	87.205	354.347	87.296	356.894	87.391	359.444	87.491	361.996	87.596	364.550	87.706	367.106	87.821	369.665	87.940	372.226	88.065	374.789	88.194	377.355	88.328	500	
400	285.515	69.913	288.065	70.013	290.618	70.120	293.174	70.233	295.732	70.352	298.293	70.477	300.857	70.608	303.424	70.746	305.994	70.889	308.566	71.038	311.141	71.194	313.718	71.355	316.299	71.523	400	
360	261.045	63.086	263.601	63.198	266.159	63.317	268.720	63.442	271.285	63.574	273.852	63.714	276.423	63.859	278.996	64.011	281.573	64.171	284.152	64.337	286.735	64.510	289.320	64.689	291.908	64.875	360	100 (P)*
350	254.929	61.383	257.486	61.498	260.046	61.620	262.609	61.749	265.175	61.885	267.744	62.028	270.317	62.178	272.892	62.334	275.471	62.498	278.052	62.669	280.637	62.846	283.224	63.031	285.813	63.222	350	
300	224.361	52.890	226.926	53.024	229.495	53.167	232.068	53.317	234.644	53.476	237.224	53.642	239.807	53.817	242.394	54.000	244.984	54.190	247.578	54.390	250.174	54.597	252.775	54.812	255.378	55.035	300	
250	193.819	44.457	196.396	44.618	198.978	44.788	201.564	44.969	204.153	45.159	206.747	45.359	209.345	45.568	211.947	45.787	214.553	46.016	217.162	46.254	219.776	46.502	222.393	46.760	225.014	47.027	250	
230	181.614	41.109	184.197	41.284	186.785	41.469	189.377	41.665	191.974	41.872	194.575	42.088	197.180	42.316	199.789	42.554	202.403	42.802	205.021	43.062	207.642	43.331	210.268	43.611	212.897	43.901	230	80 (P)*
200	163.323	36.127	165.917	36.328	168.516	36.541	171.121	36.766	173.730	37.003	176.344	37.253	178.962	37.514	181.585	37.787	184.213	38.073	186.845	38.370	189.481	38.679	192.122	39.001	194.767	39.334	200	
170	145.062	31.217	147.670	31.453	150.285	31.703	152.904	31.968	155.530	32.246	158.160	32.539	160.795	32.846	163.436	33.167	166.081	33.502	168.731	33.851	171.386	34.213	174.045	34.590	176.708	34.981	170	
155	135.947	28.801	138.565	29.060	141.188	29.334	143.817	29.624	146.452	29.929	149.093	30.250	151.738	30.586	154.389	30.937	157.045	31.304	159.706	31.686	162.371	32.083	165.042	32.495	167.716	32.923	155	65 (P)*
125	117.766	24.096	120.407	24.416	123.053	24.755	125.706	25.114	128.366	25.491	131.031	25.887	133.702	26 301	136.378	26.735	139.060	27.187	141.746	27.658	144.438	28.147	147.133	28.655	149.834	29.181	125	
100	102.692	20.393	105.358	20.791	108.031	21.213	110.711	21.658	113.397	22.126	116.089	22.618	118.786	23.132	121.489	23.670	124.197	24.230	126.909	24.813	129.626	25.418	132.346	26.045	135.070	26.695	100	
90	96.693	19.005	99.372	19.446	102.057	19.914	104.750	20.406	107.448	20.925	110.152	21.469	112.862	22.038	115.576	22.632	118.295	23.250	121.018	23.894	123.744	24.562	126.474	25.254	129.206	25.970	90	50 (P)
80	90.718	17.701	93.410	18.195	96.110	18.719	98.816	19.270	101.528	19.850	104.245	20.458	106.966	21.094	109.692	21.757	112.421	22.448	115.153	23.165	117.888	23.910	120.625	24.680	123.362	25.477	80	50 (H)**
70	84.772	16.514	87.480	17.076	90.195	17.670	92.915	18.296	95.640	18.953	98.369	19.642	101.101	20.361	103.836	21.111	106.573	21.891	109.311	22.701	112.050	23.539	114.788	24.407	117.526	25.302	70	
60	78.863	15.500	81.587	16.150	84.316	16.836	87.049	17.558	89.784	18.315	92.522	19.108	95.260	19.934	97.999	20.794	100.736	21.688	103.472	22.614	106.204	23.571	108.933	24.560	111.656	25.579	60	40 (P) *
55	75.925	15.086	78.656	15.790	81.390	16.533	84.127	17.314	86.866	18.133	89.604	18.989	92.342	19.881	95.077	20.808	97.809	21.770	100.536	22.765	103.258	23.794	105.973	24.855	108.680	25.947	55	
50	72.996	14.755	75.733	15.523	78.471	16.333	81.209	17.183	83.947	18.073	86.682	19.002	89.414	19.969	92.140	20.973	94.859	22.013	97.571	23.088	100.273	24.197	102.965	25.338	105.644	26.511	50	40 (H)**
45	70.076	14.534	72.815	15.378	75.552	16.266	78.287	17.197	81.018	18.170	83.742	19.184	86.459	20.238	89.166	21.330	91.862	22.459	94.545	23.623	97.214	24.821	99.867	26.052	102.502	27.314	45	35 (P)*
40	67.158	14.459	69.892	15.392	72.622	16.373	75.344	17.400	78.057	18.470	80.758	19.583	83.445	20.737	86.117	21.928	88.770	23.157	91.405	24.421							40	30 (H)**
35	64.225	14.579	66.944	15.622	69.651	16.714	72.344	17.853	75.019	19.036	77.674	20.263															35	
33	63.041	14.699	65.748	15.790	68.440	16.932	71.113	18.121	73.764	19.355																	33	30 (P)*
30	61.241	14.972	63.921	16.145	66.578	17.368																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P – Plain & Rolling Terrian **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 64 Degrees

$\Delta = 64°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1569.675	447.950	1572.177	447.993	1574.679	447.958	1577.182	447.963	1579.685	447.970	1582.189	447.977	1584.694	447.985	1587.198	447.995	1589.704	448.005	1592.210	448.016	1594.716	448.029	1597.223	448.042	1599.731	448.056	2500	
2200	1382.214	394.197	1384.717	394.201	1387.219	394.206	1389.722	394.212	1392.226	394.219	1394.731	394.228	1397.236	394.237	1399.741	394.248	1402.247	394.260	1404.754	394.272	1407.261	394.287	1409.770	394.302	1412.278	394.318	2200	
2000	1257.241	358.362	1259.743	358.366	1262.246	358.372	1264.750	358.379	1267.254	358.387	1269.759	358.396	1272.264	358.406	1274.771	358.418	1277.277	358.431	1279.785	358.445	1282.293	358.460	1284.802	358.477	1287.311	358.495	2000	
1800	1132.267	322.527	1134.770	322.532	1137.273	322.538	1139.777	322.545	1142.282	322.554	1144.787	322.565	1147.293	322.576	1149.800	322.589	1152.308	322.604	1154.816	322.619	1157.325	322.636	1159.835	322.655	1162.345	322.674	1800	
1500	944.807	268.775	947.311	268.781	949.814	268.788	952.319	268.797	954.825	268.807	957.331	268.820	959.838	268.833	962.347	268.849	964.856	268.866	967.365	268.885	969.876	268.906	972.388	268.928	974.900	268.952	1500	
1200	757.348	215.023	759.852	215.030	762.356	215.040	764.862	215.051	767.369	215.064	769.877	215.080	772.386	215.097	774.897	215.116	777.408	215.138	779.920	215.161	782.434	215.187	784.948	215.215	787.464	215.244	1200	
1000	632.375	179.189	634.879	179.198	637.385	179.209	639.893	179.223	642.401	179.239	644.910	179.257	647.421	179.278	649.934	179.301	652.447	179.327	654.962	179.355	657.478	179.386	659.995	179.419	662.514	179.455	1000	
900	569.889	161.273	572.394	161.282	574.900	161.295	577.408	161.310	579.917	161.327	582.428	161.348	584.940	161.371	587.454	161.397	589.969	161.426	592.485	161.457	595.003	161.491	597.522	161.528	600.043	161.568	900	
800	507.403	143.356	509.908	143.367	512.416	143.381	514.924	143.398	517.435	143.418	519.947	143.441	522.461	143.467	524.976	143.496	527.493	143.528	530.011	143.564	532.531	143.602	535.052	143.643	537.576	143.688	800	
700	444.917	125.441	447.423	125.453	449.931	125.469	452.441	125.488	454.954	125.511	457.467	125.537	459.983	125.567	462.500	125.600	465.019	125.637	467.541	125.677	470.063	125.721	472.588	125.769	475.114	125.819	700	100 (P)*
600	382.431	107.525	384.939	107.540	387.448	107.558	389.960	107.581	392.474	107.607	394.990	107.638	397.508	107.673	400.028	107.712	402.551	107.755	405.075	107.802	407.602	107.853	410.130	107.908	412.661	107.968	600	
500	319.946	89.611	322.455	89.629	324.967	89.650	327.481	89.677	329.998	89.709	332.517	89.746	335.038	89.788	337.563	89.835	340.089	89.886	342.618	89.943	345.150	90.004	347.684	90.071	350.220	90.142	500	
400	257.462	71.699	259.973	71.720	262.488	71.748	265.005	71.782	267.526	71.822	270.050	71.868	272.577	71.920	275.107	71.979	277.640	72.043	280.176	72.114	282.715	72.190	285.258	72.273	287.802	72.362	400	
360	232.469	64.535	234.982	64.559	237.497	64.589	240.017	64.627	242.540	64.671	245.066	64.722	247.596	64.781	250.130	64.845	252.666	64.917	255.206	64.995	257.750	65.081	260.296	65.173	262.846	65.272	360	
350	226.221	62.744	228.734	62.769	231.250	62.800	233.770	62.839	236.294	62.884	238.821	62.937	241.352	62.997	243.886	63.063	246.424	63.137	248.965	63.218	251.509	63.305	254.057	63.400	256.608	63.502	350	
300	194.980	53.790	197.495	53.819	200.014	53.856	202.538	53.901	205.065	53.954	207.597	54.015	210.132	54.085	212.672	54.163	215.215	54.249	217.763	54.343	220.315	54.445	222.870	54.555	225.429	54.674	300	80 (P)*
250	163.740	44.819	166.258	44.873	168.781	44.917	171.309	44.971	173.842	45.035	176.380	45.109	178.922	45.192	181.469	45.286	184.021	45.389	186.578	45.502	189.139	45.624	191.704	45.757	194.274	45.899	250	
230	151.245	41.259	153.765	41.296	156.289	41.344	158.820	41.403	161.355	41.473	163.896	41.553	166.442	41.644	168.993	41.745	171.549	41.857	174.110	41.979	176.676	42.113	179.247	42.257	181.823	42.411	230	
200	132.503	35.891	135.025	35.934	137.554	35.989	140.088	36.057	142.629	36.137	145.175	36.229	147.728	36.333	150.286	36.449	152.850	36.578	155.420	36.719	157.995	36.871	160.575	37.038	163.161	37.216	200	
170	113.762	30.525	116.288	30.576	118.821	30.641	121.362	30.720	123.909	30.814	126.463	30.923	129.025	31.045	131.592	31.182	134.167	31.334	136.747	31.500	139.334	31.680	141.928	31.874	144.527	32.083	170	65 (P)*
155	104.392	27.844	106.920	27.899	109.457	27.971	112.001	28.058	114.553	28.161	117.112	28.280	119.679	28.414	122.253	28.564	124.833	28.730	127.421	28.912	130.016	29.110	132.617	29.323	135.225	29.552	155	
125	85.635	22.486	88.190	22.554	90.735	22.643	93.289	22.751	95.852	22.878	98.425	23.026	101.006	23.192	103.595	23.379	106.193	23.584	108.799	23.809	111.413	24.054	114.035	24.318	116.664	24.601	125	
100	70.044	18.028	72.388	18.114	75.143	18.225	77.710	18.360	80.288	18.519	82.876	18.703	85.475	18.911	88.084	19.143	90.703	19.400	93.331	19.681	95.969	19.986	98.615	20.315	101.269	20.668	100	
90	63.802	16.249	66.350	16.344	68.911	16.467	71.484	16.617	74.070	16.794	76.667	16.998	79.276	17.229	81.895	17.487	84.525	17.772	87.165	18.084	89.814	18.422	92.472	18.787	95.139	19.178	90	50 (P)*
80	57.561	14.472	60.114	14.580	62.683	14.718	65.264	14.886	67.860	15.085	70.467	15.315	73.088	15.574	75.719	15.864	78.362	16.184	81.015	16.534	83.678	16.914	86.351	17.323	89.033	17.762	80	50 (H)**
70	51.322	12.700	53.883	12.823	56.460	12.981	59.052	13.173	61.659	13.400	64.280	13.662	66.914	13.959	69.561	14.289	72.219	14.654	74.888	15.053	77.568	15.485	80.258	15.951	82.956	16.450	70	
60	45.086	10.935	47.656	11.078	50.245	11.262	52.851	11.486	55.473	11.751	58.110	12.056	60.761	12.401	63.426	12.785	66.104	13.209	68.792	13.672	71.491	14.174	74.200	14.715	76.916	15.293	60	40 (P)*
55	41.930	10.056	44.546	10.212	47.142	10.412	49.756	10.657	52.387	10.945	55.034	11.277	57.696	11.653	60.371	12.072	63.059	12.533	65.759	13.037	68.468	13.582	71.187	14.169	73.913	14.797	55	
50	38.885	9.180	41.438	9.351	44.042	9.572	46.666	9.840	49.307	10.157	51.966	10.522	54.639	10.934	57.327	11.394	60.027	11.900	62.738	12.451	65.458	13.049	68.187	13.691	70.922	14.377	50	40 (H)**
45	35.842	8.308	38.314	8.499	40.948	8.744	43.582	9.042	46.236	9.393	48.907	9.798	51.594	10.254	54.295	10.763	57.007	11.322	59.730	11.932	62.465	12.597	65.200	13.299	67.943	14.054	45	35 (P)*
40	32.632	7.443	35.234	7.657	37.860	7.932	40.508	8.267	43.176	8.662	45.861	9.115	48.563	9.627	51.277	10.195	54.003	10.821	56.738	11.501	59.479	12.236	62.224	13.024	64.971	13.864	40	35 (H) 30 (P)*
35	29.529	6.581	32.140	6.831	34.780	7.145	37.444	7.526	40.129	7.976	42.831	8.491	45.548	9.072	48.277	9.717	51.015	10.425	53.759	11.191	56.506	12.023	59.253	12.909	61.997	13.852	35	
33	28.285	6.247	30.905	6.508	33.552	6.839	36.223	7.242	38.915	7.719	41.624	8.264	44.348	8.878	47.082	9.560	49.825	10.307	52.571	11.117	55.318	11.990	58.063	12.922	60.802	13.912	33	
30	26.425	5.783	29.055	6.028	31.713	6.391	34.396	6.886	37.100	7.537	39.820	7.955	42.553	8.626	45.295	9.370	48.048	10.183	50.788	11.065	53.532	12.012	56.279	13.021	58.994	14.090	30	30 (H)**
25	23.333	4.920	25.931	5.261	28.563	5.697	31.209	6.226	33.901	6.845	36.631	7.551	39.377	8.346	42.134	9.221	44.907	10.174	47.690	11.202	50.518	12.299	53.376	13.463	55.888	14.687	25	
23	22.099	4.603	24.719	4.970	27.450	5.442	30.165	6.015	32.898	6.684	35.641	7.448	38.389	8.302	41.133	9.242	43.967	10.267	46.985	11.361	49.281	12.529	51.947	13.764			23	25 (P)*
20	20.264	4.134	22.951	4.557	25.639	5.098	28.369	5.751	31.112	6.512	33.859	7.377	36.601	8.339	39.329	9.394	42.035	10.533	44.710	11.750							20	25 (H)**
15	17.198	3.418	19.911	3.927	22.628	4.685	25.364	5.533	28.124	6.511	30.852	7.608	33.533	8.812													15	20 (P)*
14	16.501	3.260	19.211	3.805	21.923	4.621	24.799	5.541	27.530	6.575	30.230	7.733															14	20 (H)**

*P – Plain & Rolling Terrain **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 64 Degrees

$\Delta = 64°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1602.239	448.071	1604.747	448.087	1607.256	448.105	1609.766	448.123	1612.276	448.142	1614.787	448.162	1617.298	448.183	1619.809	448.206	1622.321	448.229	1624.834	448.253	1627.347	448.278	1629.861	448.304	1632.375	448.331	2500	
2200	1414.787	394.335	1417.297	394.353	1419.807	394.373	1422.318	394.394	1424.829	394.416	1427.341	394.438	1429.854	394.462	1432.367	394.488	1434.881	394.514	1437.395	394.541	1439.910	394.570	1442.425	394.599	1444.941	394.630	2200	
2000	1289.821	358.514	1292.331	358.534	1294.843	358.555	1297.354	358.578	1299.867	358.602	1302.380	358.627	1304.894	358.654	1307.409	358.681	1309.924	358.710	1312.439	358.740	1314.956	358.772	1317.473	358.804	1319.990	358.838	2000	
1800	1164.856	322.696	1167.368	322.718	1169.880	322.742	1172.394	322.767	1174.907	322.794	1177.422	322.822	1179.938	322.851	1182.454	322.882	1184.970	322.914	1187.488	322.947	1190.006	322.982	1192.525	323.018	1195.044	323.056	1800	
1500	977.414	268.977	979.928	269.004	982.443	269.033	984.959	269.063	987.475	269.095	989.993	269.128	992.511	269.164	995.030	269.201	997.550	269.239	1000.071	269.279	1002.593	269.321	1005.115	269.364	1007.639	269.409	1500	
1200	789.980	215.276	792.498	215.310	795.016	215.345	797.536	215.383	800.057	215.423	802.579	215.465	805.101	215.509	807.625	215.555	810.150	215.604	812.676	215.654	815.203	215.706	817.731	215.760	820.260	215.816	1200	
1000	665.033	179.493	667.555	179.533	670.077	179.576	672.600	179.622	675.125	179.670	677.651	179.720	680.178	179.773	682.707	179.828	685.237	179.885	687.768	179.946	690.300	180.009	692.833	180.073	695.368	180.141	1000	
900	602.565	161.610	605.088	161.655	607.613	161.703	610.139	161.753	612.666	161.806	615.195	161.862	617.725	161.921	620.257	161.982	622.790	162.046	625.324	162.113	627.860	162.183	630.396	162.255	632.935	162.330	900	
800	540.100	143.736	542.626	143.786	545.154	143.840	547.683	143.897	550.214	143.957	552.746	144.020	555.280	144.086	557.815	144.155	560.353	144.227	562.891	144.302	565.431	144.380	567.972	144.462	570.515	144.546	800	
700	477.642	125.874	480.172	125.932	482.703	125.993	485.237	126.058	487.772	126.127	490.308	126.198	492.847	126.274	495.387	126.353	497.929	126.435	500.473	126.521	503.018	126.611	505.565	126.704	508.114	126.800	700	
600	415.193	108.031	417.728	108.099	420.264	108.170	422.803	108.246	425.344	108.326	427.886	108.409	430.431	108.498	432.978	108.590	435.526	108.686	438.076	108.786	440.629	108.890	443.183	108.999	445.740	109.111	600	
500	352.759	90.218	355.300	90.299	357.844	90.385	360.390	90.476	362.938	90.571	365.489	90.672	368.042	90.778	370.597	90.888	373.155	91.003	375.715	91.124	378.277	91.249	380.842	91.379	383.409	91.514	500	
400	290.351	72.457	292.902	72.558	295.456	72.666	298.012	72.779	300.572	72.899	303.135	73.025	305.700	73.156	308.268	73.295	310.839	73.439	313.413	73.589	315.990	73.745	318.569	73.907	321.151	74.076	400	
360	265.399	65.377	267.955	65.490	270.515	65.609	273.078	65.733	275.643	65.868	278.212	66.008	280.784	66.154	283.360	66.307	285.938	66.468	288.519	66.634	291.103	66.808	293.690	66.988	296.280	67.176	360	
350	259.163	63.610	261.720	63.726	264.281	63.849	266.846	63.979	269.414	64.115	271.984	64.259	274.558	64.409	277.135	64.567	279.715	64.732	282.299	64.903	284.885	65.082	287.474	65.267	290.067	65.460	350	100 (P)*
300	227.992	54.801	230.559	54.936	233.129	55.079	235.704	55.230	238.281	55.389	240.863	55.557	243.448	55.733	246.037	55.917	248.629	56.108	251.224	56.308	253.823	56.517	256.426	56.733	259.032	56.957	300	
250	196.849	46.051	199.428	46.213	202.011	46.385	204.599	46.566	207.191	46.757	209.787	46.958	212.387	47.168	214.991	47.389	217.599	47.619	220.211	47.858	222.827	48.108	225.447	48.367	228.070	48.636	250	
230	184.403	42.577	186.988	42.752	189.578	42.939	192.173	43.136	194.771	43.344	197.375	43.562	199.982	43.791	202.594	44.030	205.210	44.280	207.830	44.540	210.455	44.811	213.083	45.092	215.716	45.384	230	80 (P)*
200	165.153	37.406	168.349	37.608	170.951	37.822	173.557	38.048	176.169	38.287	178.785	38.537	181.406	38.800	184.032	39.075	186.663	39.362	189.298	39.661	191.937	39.972	194.581	40.295	197.229	40.630	200	
170	147.132	32.306	149.743	32.544	152.360	32.795	154.983	33.061	157.611	33.342	160.244	33.636	162.883	33.944	165.526	34.267	168.175	34.604	170.829	34.954	173.487	35.319	176.150	35.698	178.818	36.091	170	
155	137.839	29.796	140.459	30.057	143.085	30.322	145.717	30.624	148.355	30.931	150.999	31.253	153.648	31.591	156.303	31.944	158.962	32.313	161.627	32.697	164.297	33.096	166.971	33.511	169.650	33.940	155	65 (P)*
125	119.301	24.904	121.944	25.225	124.594	25.566	127.251	25.926	129.914	26.305	132.583	26.704	135.259	27.121	137.939	27.556	140.626	28.011	143.317	28.484	146.013	28.976	148.715	29.487	151.420	30.016	125	
100	103.911	21.044	106.611	21.445	109.279	21.869	111.963	22.316	114.654	22.787	117.351	23.282	120.054	23.799	122.762	24.339	125.475	24.903	128.194	25.489	130.916	26.097	133.643	26.728	136.374	27.381	100	
90	97.815	19.595	100.498	20.039	103.188	20.509	105.886	21.004	108.589	21.525	111.299	22.072	114.015	22.644	116.735	23.241	119.461	23.864	122.190	24.511	124.923	25.182	127.660	25.878	130.399	26.598	90	50 (P)
80	91.723	18.230	94.421	18.727	97.126	19.253	99.837	19.808	102.555	20.391	105.278	21.002	108.006	21.641	110.739	22.308	113.475	23.003	116.215	23.724	118.957	24.472	121.702	25.247	124.448	26.048	80	50 (H)**
70	85.662	16.983	88.376	17.547	91.097	18.145	93.823	18.774	96.555	19.435	99.291	20.127	102.031	20.851	104.774	21.604	107.519	22.389	110.265	23.203	113.013	24.046	115.760	24.918	118.506	25.819	70	
60	79.640	15.909	82.371	16.562	85.107	17.252	87.847	17.978	90.590	18.739	93.336	19.536	96.083	20.367	98.830	21.232	101.577	22.130	104.322	23.061	107.064	24.024	109.803	25.018	112.537	26.043	60	40 (P)*
55	76.646	15.465	79.384	16.173	82.126	16.920	84.871	17.706	87.618	18.529	90.366	19.389	93.112	20.286	95.857	21.218	98.599	22.185	101.337	23.186	104.069	24.221	106.795	25.287	109.513	26.385	55	
50	73.663	15.106	76.407	15.878	79.153	16.692	81.901	17.547	84.647	18.442	87.392	19.376	90.134	20.348	92.870	21.358	95.600	22.403	98.323	23.484	101.037	24.598	103.740	25.746	106.432	26.925	50	40 (H)**
45	70.689	14.857	73.436	15.703	76.183	16.598	78.927	17.534	81.668	18.512	84.403	19.532	87.130	20.591	89.849	21.689	92.556	22.824	95.251	23.994	97.932	25.199	100.598	26.437	103.246	27.705	45	35 (P)*
40	67.718	14.751	70.462	15.692	73.202	16.679	75.935	17.711	78.658	18.787	81.371	19.906	84.070	21.065	86.754	22.264	89.420	23.499	92.068	24.770							40	30 (H)**
35	64.736	14.848	67.465	15.896	70.184	16.994	72.888	18.139	75.575	19.329	78.243	20.562															35	
33	63.532	14.957	66.251	16.055	68.954	17.203	71.639	18.398	74.303	19.638																	33	30 (P)*
30	61.704	15.216	64.396	16.395	67.065	17.624																					30	30 (H)**
25																											25	25 (H)**
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Step Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 65 Degrees

$\Delta = 65°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metres	
2500	1600.177	464.227	1602.679	464.230	1605.181	464.235	1607.684	464.240	1610.187	464.247	1612.691	464.254	1615.196	464.262	1617.701	464.272	1620.207	464.282	1622.712	464.294	1625.219	464.306	1627.726	464.319	1630.234	464.333	2500	
2200	1409.056	408.521	1411.558	408.525	1414.061	408.530	1416.564	408.536	1419.068	408.543	1421.573	408.552	1424.078	408.561	1426.584	408.572	1429.090	408.584	1431.597	408.596	1434.104	408.611	1436.612	408.626	1439.121	408.642	2200	
2000	1281.043	371.384	1284.145	371.388	1286.648	371.393	1289.152	371.400	1291.656	371.408	1294.161	371.418	1296.667	371.428	1299.173	371.440	1301.679	371.453	1304.187	371.467	1306.695	371.482	1309.204	371.499	1311.714	371.517	2000	
1800	1154.229	334.246	1156.731	334.251	1159.235	334.257	1161.739	334.265	1164.244	334.274	1166.749	334.284	1169.255	334.296	1171.762	334.309	1174.270	334.323	1176.778	334.339	1179.288	334.356	1181.797	334.375	1184.308	334.395	1800	
1500	963.109	278.541	965.512	278.547	968.116	278.554	970.621	278.563	973.126	278.574	975.633	278.586	978.140	278.600	980.649	278.616	983.158	278.633	985.668	278.652	988.179	278.673	990.691	278.695	993.203	278.719	1500	
1200	771.989	222.836	774.493	222.843	776.998	222.853	779.504	222.864	782.011	222.877	784.519	222.893	787.028	222.910	789.539	222.930	792.050	222.951	794.563	222.975	797.076	223.001	799.591	223.029	802.107	223.058	1200	
1000	644.576	185.700	647.080	185.709	649.586	185.720	652.094	185.734	654.602	185.750	657.112	185.768	659.623	185.789	662.136	185.813	664.649	185.838	667.164	185.867	669.681	185.898	672.198	185.931	674.717	185.967	1000	
900	580.869	167.133	583.375	167.142	585.881	167.155	588.389	167.170	590.899	167.187	593.410	167.208	595.922	167.231	598.436	167.257	600.951	167.286	603.468	167.318	605.986	167.352	608.506	167.389	611.027	167.428	900	
800	517.163	148.565	519.669	148.576	522.177	148.590	524.686	148.607	527.196	148.627	529.708	148.650	532.222	148.676	534.738	148.706	537.255	148.738	539.774	148.773	542.294	148.812	544.816	148.854	547.340	148.898	800	100 (P)*
700	453.457	129.998	455.964	130.011	458.472	130.026	460.983	130.046	463.495	130.069	466.009	130.095	468.525	130.125	471.042	130.159	473.562	130.196	476.084	130.236	478.607	130.281	481.132	130.328	483.658	130.379	700	
600	389.752	111.432	392.260	111.446	394.769	111.463	397.281	111.488	399.795	111.514	402.312	111.545	404.831	111.580	407.351	111.619	409.874	111.662	412.399	111.710	414.926	111.761	417.455	111.817	419.986	111.876	600	
500	326.047	92.867	328.556	92.884	331.068	92.906	333.582	92.933	336.099	92.966	338.619	93.002	341.141	93.044	343.665	93.091	346.193	93.143	348.722	93.200	351.255	93.262	353.789	93.328	356.326	93.400	500	
480	262.343	74.303	264.854	74.325	267.369	74.353	269.887	74.387	272.408	74.427	274.932	74.473	277.460	74.526	279.991	74.584	282.524	74.649	285.061	74.720	287.601	74.797	290.144	74.881	292.690	74.970	480	
360	236.862	66.879	239.374	66.903	241.891	66.934	244.411	66.972	246.934	67.016	249.461	67.067	251.992	67.126	254.525	67.191	257.063	67.263	259.604	67.342	262.150	67.427	264.695	67.520	267.246	67.620	360	
320	230.491	65.023	233.004	65.048	235.521	65.079	238.042	65.118	240.566	65.164	243.094	65.217	245.625	65.277	248.160	65.344	250.698	65.418	253.240	65.499	255.785	65.587	258.334	65.682	260.886	65.783	320	80 (P)*
300	198.641	55.744	201.156	55.773	203.676	55.810	206.199	55.855	208.727	55.908	211.260	55.970	213.796	56.040	216.336	56.118	218.881	56.205	221.429	56.299	223.982	56.402	226.538	56.513	229.099	56.633	300	
280	166.791	46.467	169.309	46.501	171.833	46.546	174.361	46.600	176.895	46.664	179.433	46.738	181.976	46.822	184.524	46.916	187.077	47.020	189.635	47.133	192.197	47.257	194.764	47.390	197.336	47.533	280	
250	154.052	42.757	156.572	42.794	159.097	42.843	161.628	42.902	164.164	42.971	166.706	43.052	169.253	43.143	171.805	43.245	174.362	43.358	176.924	43.481	179.492	43.615	182.064	43.760	184.641	43.916	250	
230	134.943	37.193	137.466	37.237	139.995	37.292	142.531	37.360	145.072	37.440	147.620	37.533	150.173	37.638	152.733	37.755	155.298	37.885	157.869	38.026	160.446	38.180	163.028	38.347	165.616	38.526	230	
200	115.837	31.633	118.363	31.683	120.897	31.749	123.438	31.829	125.987	31.923	128.542	32.032	131.105	32.155	133.674	32.293	136.250	32.445	138.832	32.612	141.421	32.793	144.016	32.989	146.618	33.199	200	65 (P)*
175	106.284	28.854	108.813	28.909	111.350	28.981	113.895	29.069	116.448	29.172	119.009	29.291	121.577	29.427	124.152	29.578	126.734	29.745	129.324	29.928	131.921	30.126	134.524	30.341	137.134	30.571	175	
150	87.701	23.300	89.717	23.369	92.262	23.458	94.818	23.567	97.382	23.695	99.956	23.843	102.539	24.011	105.131	24.198	107.731	24.405	110.339	24.631	112.956	24.877	115.580	25.142	118.212	25.427	150	
140	71.265	18.680	73.810	18.766	76.366	18.878	78.934	19.013	81.514	19.173	84.104	19.358	86.706	19.568	89.317	19.801	91.939	20.059	94.570	20.342	97.210	20.648	99.860	20.979	102.518	21.334	140	50 (P)*
120	64.901	16.835	67.450	16.931	70.012	17.055	72.588	17.206	75.175	17.384	77.774	17.589	80.385	17.821	83.007	18.081	85.640	18.367	88.283	18.680	90.936	19.020	93.598	19.387	96.269	19.781	120	
100	58.538	14.994	61.091	15.102	63.653	15.241	66.246	15.410	68.843	15.610	71.454	15.841	74.076	16.102	76.711	16.394	79.357	16.715	82.014	17.067	84.681	17.449	87.358	17.861	90.044	18.302	100	50 (H)**
90	52.177	13.157	54.740	13.280	57.318	13.439	59.913	13.632	62.522	13.861	65.146	14.124	67.783	14.422	70.433	14.755	73.095	15.121	75.768	15.522	78.453	15.957	81.147	16.426	83.850	16.928	90	
80	45.620	11.326	48.392	11.470	50.982	11.655	53.590	11.881	56.215	12.147	58.855	12.454	61.511	12.800	64.179	13.187	66.861	13.614	69.554	14.079	72.259	14.584	74.973	15.127	77.695	15.709	80	40 (P)*
65	42.643	10.415	45.221	10.572	47.818	10.773	50.435	11.019	53.069	11.309	55.720	11.643	58.385	12.021	61.065	12.448	63.758	12.906	66.463	13.412	69.178	13.961	71.903	14.551	74.635	15.182	65	
60	39.467	9.507	42.052	9.679	44.659	9.901	47.285	10.171	49.930	10.490	52.592	10.856	55.270	11.271	57.962	11.733	60.667	12.241	63.384	12.796	66.111	13.397	68.846	14.042	71.588	14.732	60	40 (H)**
50	36.294	8.603	38.887	8.794	41.504	9.040	44.142	9.340	46.799	9.694	49.474	10.100	52.166	10.559	54.872	11.071	57.590	11.633	60.319	12.246	63.058	12.909	65.803	13.621	68.554	14.381	50	35 (P)*
45	33.123	7.703	35.727	7.921	38.356	8.197	41.007	8.534	43.679	8.930	46.370	9.386	49.076	9.901	51.792	10.473	54.529	11.101	57.271	11.786	60.019	12.525	62.773	13.317	65.528	14.161	45	35 (H) 30 (P)*
40	29.956	6.816	32.573	7.062	35.216	7.377	37.884	7.761	40.573	8.213	43.281	8.731	46.004	9.316	48.740	9.964	51.485	10.676	54.237	11.449	56.993	12.283	59.749	13.174	62.503	14.121	40	
35	28.691	6.464	31.313	6.725	33.964	7.039	36.639	7.465	39.336	7.943	42.051	8.492	44.781	9.109	47.523	9.795	50.273	10.546	53.027	11.361	55.784	12.238	58.538	13.176	61.287	14.171	35	30 (H)**
30	26.795	5.940	29.428	6.227	32.090	6.594	34.777	7.040	37.486	7.564	40.213	8.164	42.953	8.839	45.702	9.587	48.457	10.405	51.213	11.292	53.967	12.244	56.714	13.259	59.450	14.334	30	
25	23.642	5.085	26.296	5.428	28.981	5.866	31.692	6.398	34.423	7.021	37.168	7.733	39.922	8.530	42.678	9.410	45.431	10.368	48.175	11.401	50.904	12.505	53.614	13.675	56.298	14.906	25	
23	22.385	4.732	25.048	5.124	27.744	5.599	30.465	6.175	33.205	6.848	35.956	7.616	38.712	8.475	41.466	9.420	44.211	10.447	46.941	11.550	49.648	12.726	52.328	13.967			23	25 (P)*
20	20.504	4.267	23.185	4.693	25.898	5.236	28.635	5.893	31.386	6.658	34.142	7.528	36.894	8.496	39.653	9.556	42.351	10.701	45.039	11.925							20	25 (H)**
15	17.389	3.520	20.106	4.082	22.851	4.794	25.607	5.646	28.357	6.629	31.086	7.733	33.779	8.944													15	20 (P)*
14	16.770	3.386	19.496	3.986	22.246	4.743	25.001	5.649	27.743	6.689	30.455	7.852															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

$\Delta = 65°$

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 65 Degrees

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1632.742	464.349	1635.250	464.365	1637.760	464.383	1640.270	464.401	1642.780	464.420	1645.291	464.440	1647.802	464.461	1650.314	464.484	1652.826	464.507	1655.339	464.531	1657.852	464.556	1660.366	464.583	1662.881	464.610	2500	
2200	1441.630	408.659	1444.140	408.678	1446.650	408.698	1449.162	408.718	1451.673	408.740	1454.186	408.763	1456.698	408.788	1459.212	408.813	1461.726	408.839	1464.240	408.867	1466.755	408.895	1469.271	408.923	1471.787	408.956	2200	
2000	1314.224	371.536	1316.733	371.557	1319.246	371.578	1321.758	371.601	1324.271	371.625	1326.785	371.650	1329.299	371.677	1331.813	371.705	1334.329	371.734	1336.845	371.764	1339.362	371.795	1341.879	371.828	1344.397	371.862	2000	
1800	1186.819	334.416	1189.331	334.438	1191.844	334.462	1194.358	334.488	1196.872	334.515	1199.387	334.543	1201.902	334.572	1204.419	334.603	1206.936	334.635	1209.453	334.669	1211.972	334.704	1214.491	334.740	1217.011	334.778	1800	
1500	993.717	278.744	958.231	278.771	1000.747	278.800	1003.263	278.831	1005.780	278.863	1008.298	278.896	1010.816	278.932	1013.336	278.969	1015.856	279.008	1018.377	279.048	1020.900	279.090	1023.422	279.134	1025.946	279.179	1500	
1200	804.624	223.050	807.142	223.124	809.661	223.160	812.181	223.198	814.702	223.238	817.224	223.281	819.748	223.325	822.272	223.371	824.797	223.420	827.324	223.470	829.851	223.522	832.380	223.577	834.909	223.634	1200	
1000	677.237	186.005	679.759	186.046	682.282	186.089	684.806	186.135	687.331	186.183	689.857	186.233	692.385	186.287	694.915	186.342	697.445	186.400	699.976	186.461	702.509	186.524	705.043	186.589	707.578	186.657	1000	
900	613.540	167.471	616.073	167.517	618.598	167.565	621.123	167.615	623.653	167.669	626.182	167.725	628.713	167.784	631.245	167.846	633.779	167.910	636.313	167.978	638.850	168.048	641.387	168.120	643.927	168.196	900	
800	549.865	148.946	552.392	148.997	554.920	149.051	557.450	149.108	559.981	149.169	562.514	149.232	565.049	149.298	567.584	149.368	570.122	149.440	572.662	149.516	575.202	149.594	577.744	149.676	580.288	149.761	800	
700	486.187	130.434	488.718	130.492	491.250	130.554	493.784	130.619	496.320	130.688	498.857	130.760	501.396	130.836	503.937	130.916	506.480	130.998	509.024	131.085	511.571	131.175	514.119	131.268	516.668	131.365	700	
600	422.519	111.940	425.054	112.008	427.592	112.080	430.131	112.156	432.673	112.237	435.216	112.321	437.762	112.409	440.309	112.502	442.859	112.599	445.410	112.699	447.964	112.804	450.519	112.913	453.077	113.026	600	
500	358.866	93.477	361.408	93.558	363.953	93.645	366.500	93.736	369.049	93.832	371.601	93.934	374.155	94.040	376.711	94.151	379.270	94.267	381.831	94.387	384.395	94.513	386.961	94.644	389.529	94.780	500	
400	295.229	75.066	297.791	75.167	300.346	75.275	302.904	75.390	305.465	75.510	308.029	75.636	310.595	75.769	313.165	75.908	315.738	76.053	318.313	76.204	320.891	76.361	323.472	76.524	326.056	76.694	400	
360	269.800	67.726	272.358	67.839	274.919	67.959	277.483	68.086	280.050	68.219	282.620	68.360	285.194	68.507	287.771	68.661	290.350	68.822	292.933	68.990	295.519	69.165	298.108	69.346	300.700	69.534	360	100 (P)*
350	263.442	65.894	266.001	66.010	268.563	66.134	271.129	66.264	273.698	66.402	276.271	66.546	278.846	66.698	281.425	66.856	284.007	67.021	286.593	67.194	289.180	67.374	291.771	67.560	294.366	67.754	350	
300	231.663	56.760	234.231	56.896	236.803	57.040	239.379	57.192	241.959	57.352	244.542	57.520	247.129	57.697	249.719	57.882	252.313	58.075	254.911	58.276	257.512	58.485	260.117	58.702	262.723	58.928	300	
250	199.912	47.686	202.493	47.849	205.078	48.021	207.667	48.203	210.261	48.396	212.859	48.597	215.461	48.809	218.068	49.031	220.678	49.262	223.293	49.503	225.911	49.754	228.534	50.014	231.160	50.285	250	
230	187.224	44.082	189.811	44.259	192.402	44.446	194.999	44.644	197.600	44.853	200.205	45.072	202.815	45.302	205.429	45.543	208.048	45.794	210.671	46.056	213.298	46.328	215.930	46.611	218.565	46.905	230	80 (P)*
200	168.209	38.716	170.807	38.920	173.411	39.135	176.020	39.363	178.634	39.602	181.253	39.854	183.877	40.119	186.506	40.395	189.139	40.683	191.778	40.984	194.420	41.297	197.068	41.621	199.719	41.958	200	
170	149.226	33.423	151.839	33.662	154.459	33.915	157.084	34.183	159.715	34.464	162.351	34.760	164.993	35.070	167.640	35.395	170.292	35.733	172.949	36.086	175.611	36.453	178.278	36.834	180.950	37.229	170	
155	139.751	30.817	142.374	31.078	145.003	31.356	147.638	31.649	150.279	31.957	152.926	32.281	155.579	32.621	158.237	32.976	160.900	33.347	163.569	33.733	166.243	34.135	168.921	34.552	171.605	34.984	155	65 (P)*
125	120.852	25.731	123.498	26.005	126.152	26.298	128.813	26.760	131.480	27.141	134.153	27.541	136.833	27.960	139.518	28.399	142.209	28.856	144.905	29.332	147.607	29.826	150.313	30.340	153.024	30.871	125	
100	105.184	21.713	107.858	22.115	110.540	22.542	113.228	22.992	115.924	23.465	118.626	23.962	121.334	24.483	124.048	25.026	126.768	25.592	129.492	26.181	132.221	26.793	134.954	27.428	137.692	28.084	100	
90	98.569	20.200	101.636	20.647	104.332	21.119	107.034	21.617	109.743	22.141	112.459	22.691	115.180	23.266	117.907	23.867	120.639	24.492	123.375	25.143	126.115	25.818	128.859	26.518	131.606	27.242	90	50 (P)
80	92.739	18.772	95.442	19.272	98.153	19.801	100.870	20.359	103.594	20.945	106.323	21.560	109.058	22.203	111.798	22.873	114.541	23.571	117.288	24.297	120.038	25.049	122.791	25.828	125.545	26.633	80	30 (H)**
70	86.592	17.463	89.282	18.031	92.009	18.631	94.742	19.264	97.480	19.929	100.224	20.625	102.971	21.352	105.721	22.110	108.475	22.899	111.230	23.717	113.986	24.565	116.742	25.442	119.498	26.348	70	
60	80.426	16.228	83.163	16.985	85.906	17.678	88.654	18.408	91.405	19.174	94.159	19.975	96.914	20.811	99.671	21.680	102.427	22.584	105.181	23.520	107.934	24.488	110.683	25.487	113.427	26.518	60	40 (P)*
55	77.373	15.854	80.120	16.566	82.870	17.317	85.624	18.107	88.379	18.935	91.135	19.800	93.891	20.702	96.646	21.639	99.398	22.612	102.146	23.618	104.889	24.658	107.626	25.730	110.355	26.834	55	
50	74.336	15.466	77.088	16.242	79.843	17.060	82.600	17.920	85.356	18.820	88.110	19.759	90.861	20.737	93.608	21.752	96.349	22.803	99.083	23.890	101.808	25.010	104.524	26.164	107.228	27.350	50	40 (H)**
45	71.308	15.167	74.064	16.040	76.820	16.938	79.574	17.879	82.325	18.863	85.070	19.888	87.809	20.953	90.539	22.057	93.258	23.198	95.965	24.375	98.659	25.587	101.337	26.831	103.999	28.107	45	35 (P)*
40	68.285	15.056	71.039	16.000	73.788	16.992	76.532	18.029	79.267	19.112	81.991	20.237	84.702	21.403	87.398	22.608	90.077	23.850	92.738	25.128							40	30 (H)**
35	65.251	15.123	67.992	16.177	70.722	17.281	73.438	18.432	76.137	19.629	78.818	20.869															35	
33	64.029	15.222	66.758	16.323	69.473	17.480	72.171	18.682	74.847	19.929																	33	30 (P)*
30	62.172	15.466	64.876	16.651	67.558	17.887																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

**P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 66 Degrees

$\Delta = 66°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	1631.020	480.911	1633.522	480.915	1636.025	480.919	1638.527	480.925	1641.031	480.931	1643.535	480.939	1646.040	480.947	1648.545	480.957	1651.051	480.967	1653.556	480.979	1656.063	480.991	1658.571	481.004	1661.078	481.019	2500	
2250	1436.198	423.203	1438.700	423.207	1441.203	423.212	1443.707	423.219	1446.211	423.226	1448.715	423.234	1451.220	423.244	1453.726	423.255	1456.233	423.267	1458.740	423.279	1461.247	423.294	1463.756	423.309	1466.264	423.325	2250	
2000	1306.317	384.731	1308.820	384.735	1311.323	384.741	1313.826	384.748	1316.331	384.756	1318.836	384.765	1321.342	384.776	1323.848	384.788	1326.355	384.801	1328.863	384.815	1331.371	384.831	1333.880	384.847	1336.390	384.865	2000	
1800	1176.426	346.259	1178.939	346.264	1181.442	346.270	1183.946	346.278	1186.451	346.287	1188.957	346.297	1191.463	346.309	1193.970	346.322	1196.478	346.337	1198.987	346.352	1201.496	346.370	1204.006	346.388	1206.517	346.408	1800	
1600	981.615	288.552	984.118	288.558	986.622	288.565	989.127	288.574	991.633	288.585	994.139	288.597	996.647	288.611	999.156	288.627	1001.665	288.644	1004.175	288.664	1006.687	288.684	1009.198	288.707	1011.711	288.730	1600	
1200	786.794	230.845	789.298	230.852	791.803	230.861	794.309	230.873	796.816	230.886	799.324	230.902	801.834	230.919	804.345	230.939	806.856	230.960	809.369	230.984	811.883	231.010	814.398	231.038	816.914	231.068	1200	
1000	656.913	192.374	659.418	192.383	661.924	192.394	664.431	192.408	666.940	192.424	669.450	192.442	671.961	192.464	674.474	192.487	676.988	192.513	679.503	192.542	682.020	192.573	684.538	192.606	687.058	192.642	1000	
900	591.973	173.139	594.479	173.149	596.985	173.161	599.493	173.176	602.003	173.194	604.514	173.215	607.027	173.238	609.541	173.264	612.057	173.294	614.573	173.325	617.092	173.360	619.612	173.397	622.133	173.437	900	
800	527.035	153.904	529.539	153.915	532.047	153.929	534.556	153.946	537.067	153.966	539.579	153.990	542.094	154.016	544.609	154.045	547.127	154.078	549.646	154.114	552.167	154.153	554.689	154.194	557.213	154.240	800	
700	462.094	134.670	464.601	134.682	467.109	134.698	469.619	134.718	472.132	134.741	474.646	134.768	477.163	134.798	479.680	134.831	482.200	134.868	484.722	134.909	487.246	134.954	489.771	135.002	492.299	135.053	700	100 (P)*
640	397.134	115.436	399.662	115.451	402.172	115.469	404.685	115.492	407.199	115.519	409.716	115.550	412.235	115.585	414.756	115.625	417.279	115.668	419.804	115.716	422.332	115.768	424.861	115.823	427.393	115.884	640	
600	332.216	96.204	334.725	96.221	337.237	96.243	339.752	96.271	342.269	96.303	344.789	96.340	347.312	96.383	349.837	96.430	352.365	96.482	354.895	96.539	357.427	96.601	359.963	96.668	362.501	96.740	600	
500	267.278	76.973	269.790	76.995	272.305	77.023	274.823	77.057	277.344	77.097	279.869	77.144	282.397	77.197	284.929	77.256	287.463	77.321	290.001	77.392	292.542	77.470	295.085	77.553	297.632	77.644	500	
450	241.303	69.282	243.816	69.306	246.333	69.337	248.853	69.375	251.377	69.420	253.905	69.471	256.436	69.530	258.970	69.595	261.509	69.668	264.050	69.747	266.595	69.833	269.144	69.927	271.696	70.027	450	
400	214.810	61.359	217.323	61.384	239.840	67.416	242.361	67.455	244.886	67.501	247.414	67.554	249.946	67.614	252.481	67.682	255.021	67.756	257.563	67.838	260.110	67.927	262.659	68.022	265.213	68.125	400	80 (P)*
360	202.342	57.746	204.858	57.775	207.378	57.813	209.902	57.858	212.431	57.912	214.963	57.974	217.501	58.044	220.042	58.123	222.587	58.209	225.137	58.305	227.690	58.408	230.248	58.520	232.810	58.640	360	
320	169.876	48.135	172.395	48.170	174.918	48.215	177.447	48.270	179.981	48.334	182.521	48.409	185.065	48.493	187.614	48.587	190.168	48.692	192.727	48.806	195.290	48.930	197.859	49.064	200.432	49.208	320	
280	148.890	44.292	150.410	44.330	161.936	44.378	164.467	44.438	167.004	44.508	169.547	44.589	172.095	44.681	174.648	44.783	177.206	44.896	179.770	45.021	182.339	45.156	184.913	45.301	187.492	45.457	280	
250	137.412	38.528	139.935	38.572	142.464	38.628	145.000	38.696	147.543	38.777	150.091	38.870	152.646	38.975	155.206	39.093	157.773	39.223	160.346	39.366	162.924	39.521	165.508	39.688	168.098	39.868	250	
220	117.935	32.767	120.462	32.819	122.996	32.884	125.539	32.965	128.088	33.060	130.645	33.169	133.208	33.293	135.779	33.432	138.356	33.585	140.940	33.753	143.531	33.935	146.129	34.132	148.732	34.343	220	65 (P)*
200	106.197	29.888	110.727	29.944	113.264	30.017	115.810	30.105	118.364	30.209	120.926	30.329	123.496	30.465	126.072	30.617	128.657	30.785	131.248	30.969	133.847	31.168	136.453	31.384	139.065	31.615	200	
175	86.724	24.135	91.260	24.204	93.807	24.294	96.363	24.403	98.929	24.532	101.505	24.681	104.089	24.849	106.683	25.038	109.285	25.246	111.896	25.473	114.515	25.721	117.142	25.987	119.777	26.274	175	
150	72.500	19.348	75.046	19.435	77.603	19.547	80.173	19.683	82.754	19.844	85.346	20.030	87.950	20.241	90.564	20.476	93.188	20.735	95.822	21.019	98.466	21.327	101.118	21.660	103.780	22.017	150	
125	66.013	17.437	68.563	17.533	71.126	17.657	73.703	17.809	76.292	17.988	78.894	18.194	81.507	18.428	84.132	18.689	86.768	18.977	89.414	19.292	92.070	19.634	94.736	20.003	97.411	20.399	125	50 (P)*
110	59.526	15.529	62.083	15.637	64.654	15.777	67.239	15.947	69.838	16.148	72.451	16.380	75.076	16.643	77.714	16.936	80.363	17.260	83.024	17.614	85.695	17.997	88.377	18.411	91.067	18.855	110	
100	53.043	13.625	55.606	13.749	58.187	13.908	60.783	14.103	63.395	14.333	66.021	14.598	68.661	14.897	71.315	15.232	73.981	15.601	76.658	16.004	79.347	16.441	82.046	16.912	84.755	17.417	100	50 (H)**
90	46.562	11.728	49.135	11.873	51.728	12.058	54.338	12.285	56.966	12.553	59.609	12.861	62.268	13.210	64.941	13.599	67.627	14.028	70.325	14.496	73.035	15.004	75.754	15.550	78.483	16.133	90	40 (P)*
80	43.323	10.783	45.903	10.941	48.503	11.143	51.122	11.391	53.759	11.683	56.413	12.018	59.083	12.398	61.767	12.822	64.465	13.288	67.175	13.798	69.896	14.349	72.626	14.943	75.366	15.578	80	
70	40.086	9.842	42.673	10.015	45.282	10.238	47.911	10.510	50.559	10.830	53.225	11.199	55.907	11.616	58.604	12.080	61.315	12.592	64.037	13.150	66.770	13.753	69.512	14.403	72.262	15.096	70	40 (H)**
65	36.852	8.904	39.447	9.097	42.066	9.344	44.707	9.646	47.368	10.001	50.048	10.410	52.744	10.872	55.455	11.386	58.179	11.952	60.915	12.568	63.660	13.235	66.413	13.951	69.171	14.715	65	35 (P)*
60	33.620	7.974	36.225	8.190	38.827	8.468	41.512	8.807	44.183	9.206	46.884	9.664	49.596	10.181	52.322	10.757	55.061	11.389	57.809	12.077	60.566	12.820	63.327	13.617	66.092	14.466	60	35 (H) 30 (P)*
55	30.391	7.052	33.010	7.299	35.637	7.616	38.329	8.002	41.023	8.456	43.736	8.978	46.465	9.565	49.208	10.217	51.961	10.933	54.721	11.711	57.485	12.549	60.250	13.445	63.014	14.398	55	
50	29.102	6.686	31.727	6.948	34.381	7.284	37.060	7.693	39.762	8.174	42.483	8.725	45.219	9.347	47.968	10.036	50.726	10.791	53.489	11.611	56.254	12.493	59.018	13.436	61.778	14.436	50	
45	27.169	6.143	29.805	6.431	32.470	6.800	35.163	7.248	37.877	7.775	40.610	8.379	43.357	9.058	46.114	9.810	48.878	10.633	51.643	11.524	54.406	12.482	57.164	13.502	59.911	14.583	45	30 (H)**
40	23.935	5.253	26.613	5.599	29.302	6.040	32.019	6.575	34.756	7.201	37.509	7.917	40.271	8.719	43.036	9.604	45.799	10.567	48.555	11.606	51.304	12.716	54.046	13.893	56.774	15.131	40	
35	22.674	4.909	25.341	5.283	28.042	5.760	30.769	6.339	33.516	7.016	36.275	7.789	39.040	8.652	41.804	9.602	44.559	10.635	47.300	11.745	50.050	12.927	52.712	14.175			35	25 (P)*
30	20.756	4.403	23.442	4.832	26.161	5.378	28.905	6.039	31.664	6.808	34.429	7.683	37.191	8.656	39.941	9.722	42.670	10.874	45.371	12.105							30	25 (H)**
25	17.581	3.624	20.305	4.189	23.057	4.905	25.822	5.762	28.582	6.751	31.322	7.861	34.028	9.078													25	20 (P)*
24	16.951	3.483	19.683	4.087	22.441	4.849	25.206	5.759	27.959	6.806	30.682	7.975															24	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 66 Degrees

$\Delta = 66°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metres	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metres	
2500	1663.587	481.034	1668.095	481.051	1668.605	481.068	1671.115	481.086	1673.625	481.106	1676.136	481.126	1678.648	481.147	1681.160	481.170	1683.672	481.193	1686.186	481.218	1688.699	481.243	1691.213	481.269	1693.728	481.296	2500	
2250	1468.774	423.343	1471.284	423.361	1473.794	423.381	1476.306	423.402	1478.818	423.424	1481.330	423.447	1483.843	423.471	1486.357	423.497	1488.871	423.523	1491.386	423.551	1493.902	423.580	1496.417	423.610	1498.934	423.641	2250	
2000	1338.980	384.885	1341.411	384.905	1343.923	384.927	1346.435	384.950	1348.948	384.974	1351.462	385.000	1353.977	385.026	1356.491	385.054	1359.007	385.083	1361.524	385.114	1364.041	385.145	1366.558	385.178	1369.076	385.212	2000	
1800	1209.028	346.430	1211.541	346.452	1214.053	346.477	1216.567	346.502	1219.082	346.529	1221.597	346.557	1224.113	346.587	1226.630	346.618	1229.147	346.650	1231.665	346.684	1234.184	346.719	1236.704	346.756	1239.224	346.794	1800	
1500	1014.225	288.756	1016.740	288.783	1019.256	288.813	1021.772	288.843	1024.289	288.875	1026.807	288.909	1029.326	288.945	1031.846	288.982	1034.367	289.021	1036.889	289.062	1039.411	289.104	1041.935	289.148	1044.459	289.193	1500	
1200	819.431	231.100	821.950	231.135	824.469	231.171	826.990	231.209	829.511	231.249	832.034	231.292	834.557	231.336	837.082	231.383	839.608	231.432	842.135	231.482	844.663	231.535	847.192	231.590	849.723	231.647	1200	
1000	689.578	192.681	692.100	192.722	694.623	192.765	697.148	192.811	699.674	192.860	702.200	192.910	704.729	192.964	707.259	193.020	709.790	193.078	712.322	193.139	714.855	193.202	717.390	193.268	719.926	193.336	1000	
900	624.656	173.480	627.180	173.525	629.706	173.574	632.233	173.625	634.762	173.678	637.292	173.735	639.823	173.794	642.356	173.856	644.890	173.921	647.426	173.989	649.963	174.059	652.501	174.132	655.041	174.208	900	
800	559.739	154.288	562.266	154.339	564.795	154.393	567.325	154.451	569.857	154.511	572.391	154.575	574.926	154.642	577.463	154.711	580.001	154.784	582.542	154.861	585.083	154.939	587.626	155.022	590.171	155.107	800	
700	494.828	135.108	497.359	135.167	499.892	135.229	502.427	135.294	504.963	135.364	507.501	135.436	510.041	135.512	512.583	135.593	515.127	135.676	517.672	135.762	520.219	135.853	522.768	135.947	525.319	136.044	700	
600	429.927	115.948	432.463	116.016	435.001	116.088	437.541	116.165	440.084	116.246	442.628	116.330	445.174	116.419	447.723	116.512	450.273	116.610	452.826	116.711	455.381	116.816	457.937	116.926	460.496	117.040	600	
500	365.041	96.817	367.584	96.899	370.130	96.986	372.678	97.078	375.228	97.175	377.781	97.277	380.336	97.383	382.894	97.495	385.454	97.612	388.016	97.733	390.581	97.860	393.148	97.991	395.718	98.127	500	
480	350.182	77.740	352.725	77.842	305.292	77.951	307.851	78.066	310.413	78.186	312.978	78.313	315.546	78.447	318.117	78.587	320.691	78.732	323.268	78.884	325.848	79.042	328.430	79.206	331.016	79.377	480	
450	274.251	70.134	276.810	70.247	279.372	70.368	281.937	70.495	284.505	70.630	287.077	70.771	289.653	70.919	292.231	71.074	294.812	71.236	297.397	71.405	299.985	71.580	302.576	71.762	305.170	71.952	450	100 (P)*
400	267.770	68.235	270.330	68.352	272.894	68.476	275.461	68.607	278.031	68.746	280.605	68.891	283.182	69.043	285.762	69.203	288.346	69.369	290.933	69.542	293.523	69.723	296.116	69.911	298.712	70.105	400	
350	233.375	58.768	237.945	58.904	240.518	59.049	243.096	59.202	245.677	59.363	248.262	59.533	250.851	59.710	253.443	59.896	256.039	60.090	258.639	60.292	261.242	60.503	263.849	60.721	266.460	60.948	350	
300	203.016	49.361	205.592	49.523	208.179	49.698	210.770	49.882	213.366	50.075	215.966	50.278	218.571	50.491	221.179	50.714	223.792	50.947	226.409	51.189	229.030	51.441	231.656	51.700	234.285	51.975	300	
250	180.075	45.625	182.664	45.802	185.258	45.991	187.856	46.190	190.459	46.400	193.067	46.621	195.680	46.852	198.296	47.094	200.918	47.346	203.544	47.610	206.174	47.884	208.808	48.168	211.446	48.463	250	80 (P)*
200	170.693	40.060	173.293	40.264	175.899	40.481	178.511	40.710	181.127	40.951	183.749	41.205	186.376	41.470	189.007	41.748	191.644	42.038	194.285	42.340	196.931	42.655	199.582	42.981	202.237	43.320	200	
175	151.342	34.568	153.958	34.808	156.580	35.063	159.208	35.332	161.842	35.615	164.482	35.913	167.127	36.225	169.777	36.551	172.433	36.891	175.094	37.246	177.760	37.615	180.431	37.998	183.106	38.395	175	
150	141.684	31.863	144.310	32.126	146.942	32.405	149.580	32.699	152.224	33.010	154.875	33.336	157.531	33.677	160.193	34.034	162.860	34.407	165.533	34.796	168.211	35.199	170.894	35.618	173.582	36.053	150	65 (P)*
125	122.400	26.580	125.070	26.905	127.727	27.250	130.392	27.614	133.063	27.997	135.740	28.400	138.424	28.821	141.114	29.262	143.810	29.722	146.511	30.200	149.218	30.698	151.929	31.214	154.646	31.749	125	
100	106.450	22.398	109.129	22.803	111.815	23.232	114.508	23.684	117.209	24.160	119.916	24.660	122.630	25.183	125.349	25.730	128.075	26.299	130.805	26.892	133.540	27.507	136.280	28.145	139.024	28.805	100	
90	100.095	20.821	102.788	21.269	105.488	21.744	108.196	22.245	110.910	22.772	113.631	23.325	116.359	23.904	119.092	24.508	121.830	25.137	124.573	25.791	127.320	26.470	130.071	27.173	132.826	27.901	90	50 (P)
80	93.767	19.328	96.475	19.831	99.191	20.363	101.914	20.924	104.644	21.513	107.380	22.131	110.122	22.778	112.868	23.452	115.619	24.154	118.374	24.884	121.131	25.640	123.892	26.424	126.655	27.234	80	30 (H)**
70	87.472	17.955	90.198	18.526	92.931	19.130	95.671	19.766	98.416	20.435	101.166	21.135	103.921	21.866	106.680	22.629	109.441	23.422	112.205	24.245	114.970	25.097	117.735	25.979	120.500	26.890	70	
60	81.220	16.728	83.964	17.418	86.714	18.116	89.469	18.850	92.229	19.620	94.991	20.425	97.755	21.266	100.521	22.140	103.286	23.048	106.050	23.990	108.813	24.963	111.572	25.969	114.328	27.003	60	40 (P)*
55	78.112	16.253	80.865	16.969	83.623	17.724	86.384	18.519	89.148	19.351	91.914	20.221	94.679	21.128	97.443	22.071	100.205	23.048	102.964	24.061	105.718	25.106	108.466	26.185	111.207	27.295	55	
50	75.017	15.834	77.778	16.615	80.541	17.438	83.306	18.302	86.072	19.207	88.836	20.152	91.597	21.133	94.355	22.155	97.107	23.213	99.852	24.305	102.589	25.433	105.316	26.593	104.033	27. 85	50	40 (H)**
45	71.934	15.526	74.699	16.384	77.465	17.286	80.229	18.233	82.990	19.222	85.746	20.253	88.495	21.325	91.236	22.435	93.967	23.582	96.687	24.766	99.393	25.984	102.084	27.235	104.759	28. 18	45	35 (P)*
40	68.847	15.266	71.621	16.315	74.381	17.312	77.136	18.356	79.882	19.444	82.617	20.576	85.341	21.748	88.049	22.960	90.742	24.209	93.415	25.494							40	30 (H)**
38	65.773	15.405	68.524	16.465	71.266	17.575	73.993	18.733	76.706	19.936	79.399	21.183															38	
33	64.530	15.493	67.271	16.603	69.998	17.764	72.708	18.973	75.398	20.227																	33	30 (P)*
30	62.645	15.722	65.361	16.914	68.056	18.157																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 67°$

Deviation Angle = 67 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1662.215	498.016	1664.717	498.019	1667.219	498.024	1669.722	498.029	1672.226	498.036	1674.730	498.043	1677.235	498.052	1679.740	498.061	1682.246	498.072	1684.752	498.083	1687.259	498.095	1689.766	498.109	1692.274	498.124	2500	
2200	1463.650	438.255	1466.152	438.259	1468.655	438.264	1471.158	438.270	1473.662	438.278	1476.167	438.286	1478.672	438.296	1481.178	438.307	1483.685	438.319	1486.192	438.332	1488.700	438.346	1491.208	438.361	1493.717	438.377	2200	
2000	1331.273	398.415	1333.775	398.419	1336.279	398.424	1338.782	398.431	1341.287	398.440	1343.792	398.449	1346.298	398.459	1348.804	398.471	1351.311	398.484	1353.819	398.499	1356.328	398.515	1358.837	398.531	1361.347	398.549	2000	
1800	1198.896	358.574	1201.399	358.579	1203.903	358.585	1206.407	358.593	1208.912	358.602	1211.417	358.613	1213.924	358.624	1216.431	358.637	1218.939	358.652	1221.448	358.668	1223.958	358.685	1226.468	358.704	1228.979	358.724	1800	
1500	1000.332	298.814	1002.835	298.820	1005.339	298.827	1007.844	298.836	1010.350	298.847	1012.857	298.860	1015.364	298.874	1017.873	298.890	1020.383	298.907	1022.893	298.927	1025.405	298.948	1027.917	298.970	1030.430	298.994	1500	
1200	801.767	239.055	804.271	239.062	806.776	239.071	809.283	239.083	811.790	239.096	814.299	239.112	816.808	239.130	819.319	239.150	821.831	239.171	824.344	239.195	826.858	239.221	829.374	239.250	831.890	239.280	1200	
1000	669.391	199.216	671.896	199.224	674.402	199.236	676.910	199.250	679.418	199.266	681.929	199.284	684.440	199.306	686.953	199.329	689.468	199.355	691.983	199.384	694.500	199.416	697.019	199.449	699.538	199.486	1000	
900	603.203	179.297	605.709	179.306	608.216	179.319	610.724	179.334	613.234	179.352	615.745	179.373	618.258	179.396	620.772	179.423	623.289	179.452	625.806	179.484	628.324	179.519	630.845	179.556	633.367	179.596	900	
800	537.016	159.378	539.522	159.388	542.030	159.403	544.539	159.420	547.050	159.440	549.562	159.463	552.077	157.490	554.593	159.520	557.111	159.552	559.631	159.588	562.152	159.627	564.675	159.669	567.199	159.715	800	
700	470.828	139.459	473.335	139.472	475.844	139.488	478.355	139.507	480.867	139.531	483.382	139.557	485.899	139.588	488.417	139.621	490.937	139.659	493.460	139.700	495.983	139.745	498.510	139.793	501.037	139.844	700	100 (P)*
600	404.681	119.542	407.189	119.556	409.659	119.574	412.172	119.598	414.687	119.625	417.204	119.656	419.723	119.691	422.244	119.731	424.768	119.774	427.294	119.823	429.822	119.875	432.352	119.931	434.885	119.991	600	
500	338.455	99.625	340.964	99.642	343.477	99.665	345.992	99.692	348.509	99.725	351.030	99.762	353.553	99.804	356.078	99.852	358.606	99.904	361.137	99.962	363.671	100.024	366.207	100.092	368.746	100.164	500	
480	272.270	79.710	274.781	79.732	277.297	79.760	279.815	79.794	282.337	79.835	284.863	79.882	287.391	79.935	289.923	79.994	292.458	80.060	294.997	80.132	297.538	80.209	300.083	80.294	302.631	80.384	480	
460	245.796	71.745	248.309	71.769	250.826	71.800	253.347	71.839	255.871	71.884	258.399	71.936	260.931	71.995	263.466	72.061	266.005	72.134	268.547	72.213	271.093	72.300	273.643	72.393	276.196	72.494	460	
440	219.177	63.754	241.691	63.779	244.208	63.811	246.730	63.850	249.255	63.896	251.784	63.950	254.316	70.010	256.853	70.078	259.392	70.153	261.936	70.235	264.483	70.325	267.034	70.421	269.588	70.524	440	
420	206.086	59.799	208.602	59.828	211.122	59.865	213.647	59.911	216.176	59.963	218.710	60.028	221.247	60.099	223.789	60.178	226.336	60.265	228.886	60.361	231.441	60.465	234.000	60.577	236.563	60.698	420	80 (P)*
400	172.996	49.846	175.515	49.881	178.039	49.926	180.569	49.981	183.104	50.046	185.643	50.121	188.188	50.206	190.739	50.301	193.294	50.406	195.854	50.520	198.419	50.645	200.989	50.780	203.563	50.925	400	
380	159.760	45.865	162.281	45.904	164.807	45.953	167.339	46.012	169.877	46.083	172.420	46.165	174.969	46.257	177.523	46.360	180.083	46.474	182.648	46.599	185.218	46.734	187.794	46.881	190.374	47.038	380	
360	139.908	39.897	142.431	39.941	144.962	39.997	147.498	40.066	150.041	40.147	152.591	40.240	155.147	40.347	157.709	40.465	160.277	40.596	162.851	40.740	165.430	40.895	168.016	41.064	170.608	41.244	360	
340	120.036	33.911	122.584	33.982	125.120	34.048	127.663	34.129	130.213	34.225	132.771	34.335	135.336	34.460	137.908	34.599	140.487	34.753	143.073	34.922	145.665	35.105	148.265	35.303	150.871	35.515	340	65 (P)*
320	110.132	30.949	112.662	31.006	115.201	31.078	117.748	31.167	120.303	31.271	122.866	31.392	125.436	31.529	128.015	31.682	130.601	31.851	133.194	32.036	135.795	32.237	138.403	32.453	141.018	32.686	320	
300	90.284	24.990	92.822	25.060	95.369	25.150	97.927	25.260	100.494	25.390	103.071	25.540	105.658	25.709	108.253	25.898	110.858	26.108	113.471	26.337	116.092	26.585	118.722	26.854	121.360	27.142	300	
280	73.749	20.033	76.295	20.120	78.854	20.233	81.425	20.370	84.008	20.532	86.602	20.719	89.208	20.930	91.824	21.167	94.451	21.428	97.088	21.713	99.735	22.024	102.392	22.358	105.057	22.717	280	
260	61.137	18.053	63.688	18.130	72.253	18.275	74.831	18.428	77.422	18.608	80.026	18.815	82.642	19.050	85.269	19.313	87.908	19.602	90.558	19.919	93.218	20.263	95.887	20.634	98.567	21.032	260	50 (P)*
240	60.526	16.077	63.083	16.186	65.656	16.326	68.243	16.498	70.844	16.700	73.460	16.933	76.088	17.198	78.728	17.492	81.381	17.818	84.046	18.174	86.721	18.560	89.406	18.976	92.102	19.422	240	50 (H)**
220	53.918	14.105	56.481	14.230	59.065	14.390	61.663	14.586	64.277	14.817	66.906	15.083	69.550	15.384	72.207	15.721	74.876	16.092	77.558	16.497	80.252	16.937	82.956	17.411	85.670	17.919	220	
200	47.313	12.140	49.888	12.285	52.482	12.472	55.095	12.700	57.725	12.969	60.372	13.279	63.034	13.630	65.711	14.021	68.402	14.453	71.105	14.924	73.820	15.434	76.545	15.984	79.280	16.572	200	
180	41.012	11.161	46.593	11.319	49.195	11.523	51.817	11.772	54.457	12.065	57.114	12.403	59.788	12.785	62.477	13.211	65.179	13.680	67.895	14.192	70.621	14.747	73.358	15.344	76.104	15.982	180	
160	40.713	10.185	43.301	10.339	45.912	10.583	48.544	10.857	51.196	11.179	53.866	11.550	56.552	11.969	59.254	12.436	61.970	12.951	64.698	13.512	67.437	14.119	70.186	14.772	72.943	15.470	160	40 (H)**
140	37.416	9.214	40.013	9.404	42.635	9.656	45.279	9.969	47.944	10.317	50.628	10.728	53.329	11.193	56.045	11.710	58.775	12.279	61.517	12.899	64.269	13.569	67.030	14.289	69.796	15.057	140	35 (P)**
120	34.122	8.249	36.730	8.467	39.364	8.749	42.023	9.087	44.703	9.488	47.403	9.949	50.121	10.469	52.853	11.048	55.599	11.684	58.354	12.376	61.118	13.121	63.888	13.924	66.662	14.778	120	35 (H) 30 (P)*
100	30.832	7.293	33.453	7.542	36.103	7.860	38.779	8.249	41.478	8.705	44.196	9.230	46.932	9.821	49.681	10.477	52.441	11.197	55.209	11.979	57.982	12.821	60.757	13.723	63.531	14.681	100	
90	29.317	6.914	32.145	7.117	34.802	7.515	37.486	7.926	40.193	8.410	42.920	8.965	45.663	9.589	48.418	10.282	51.184	11.042	53.956	11.867	56.730	12.754	59.504	13.702	62.275	14.709	90	
80	27.547	6.350	30.186	6.640	32.856	7.011	35.552	7.462	38.272	7.992	41.012	8.599	43.766	9.282	46.531	10.038	49.303	10.866	52.078	11.762	54.851	12.725	57.619	13.752	60.378	14.839	80	30 (H)**
70	24.272	5.428	26.933	5.775	29.627	6.218	32.349	6.786	35.095	7.486	37.855	8.706	40.623	8.912	43.398	9.802	46.171	10.771	48.937	11.816	51.689	12.933	54.423	14.116	57.134	15.361	70	
60	22.966	5.069	25.637	5.445	28.341	5.925	31.076	6.508	33.830	7.189	36.597	7.965	39.371	8.834	42.145	9.789	44.911	10.828	47.664	11.944	50.396	13.133	53.102	14.358			60	25 (P)*
50	21.011	4.543	23.702	4.975	26.427	5.524	29.177	6.188	31.944	6.962	34.718	7.842	37.491	8.821	40.252	9.893	42.993	11.051	45.707	12.389							50	25 (H)**
45	17.776	3.731	20.506	4.300	23.265	5.019	26.039	5.881	28.810	6.876	31.562	7.992	34.280	9.217													45	20 (P)*
40	17.134	3.584	19.872	4.191	22.638	4.957	25.412	5.872	28.176	6.925	30.912	8.101															40	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 67 Degrees

$\Delta = 67°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1694.783	498.139	1697.292	498.156	1699.801	498.173	1702.312	498.191	1704.822	498.211	1707.333	498.232	1709.845	498.253	1712.357	498.275	1714.870	498.299	1717.384	498.323	1719.897	498.349	1722.412	498.375	1724.927	498.403	2500	
2200	1496.227	438.395	1498.737	438.414	1501.248	438.434	1503.759	438.455	1506.271	438.477	1508.784	438.500	1511.297	438.525	1513.812	438.550	1516.326	438.577	1518.841	438.605	1521.357	438.634	1523.873	438.664	1526.390	438.695	2200	
2000	1363.858	398.569	1366.369	398.590	1368.881	398.611	1371.393	398.634	1373.907	398.659	1376.421	398.684	1378.935	398.711	1381.451	398.739	1383.967	398.769	1386.483	398.799	1389.001	398.831	1391.519	398.864	1394.037	398.898	2000	
1800	1231.490	358.746	1234.003	358.769	1236.516	358.793	1239.030	358.819	1241.545	358.845	1244.060	358.874	1246.577	358.904	1249.094	358.935	1251.611	358.968	1254.130	359.002	1256.649	359.037	1259.169	359.074	1261.690	359.112	1800	
1500	1032.944	299.020	1035.459	299.047	1037.975	299.077	1040.492	299.107	1043.009	299.140	1045.528	299.174	1048.048	299.210	1050.568	299.247	1053.089	299.286	1055.611	299.327	1058.134	299.370	1060.658	299.414	1063.183	299.459	1500	
1200	834.407	239.312	836.926	239.346	839.446	239.382	841.967	239.421	844.489	239.462	847.012	239.504	849.536	239.549	852.062	239.596	854.588	239.645	857.115	239.696	859.644	239.749	862.174	239.804	864.705	239.861	1200	
1000	702.059	199.324	704.582	199.565	707.105	199.609	709.630	199.655	712.157	199.704	714.684	199.755	717.213	199.809	719.743	199.865	722.275	199.924	724.808	199.985	727.342	200.049	729.877	200.115	732.414	200.184	1000	
900	635.890	179.639	638.415	179.685	640.941	179.734	643.469	179.785	645.998	179.839	648.528	179.896	651.060	179.956	653.594	180.018	656.129	180.083	658.665	180.151	661.203	180.222	663.742	180.296	666.283	180.372	900	
800	569.725	159.763	572.253	159.815	574.782	159.869	577.313	159.927	579.846	159.988	582.380	160.052	584.917	160.119	587.454	160.189	589.993	160.263	592.534	160.339	595.076	160.419	597.620	160.501	600.166	160.587	800	
700	503.567	139.900	506.099	139.959	508.633	140.021	511.168	140.087	513.705	140.157	516.244	140.230	518.785	140.306	521.327	140.387	523.872	140.471	526.418	140.558	528.967	140.649	531.516	140.744	534.068	140.842	700	
600	437.419	120.055	439.956	120.124	442.495	120.197	445.036	120.274	447.579	120.355	450.124	120.440	452.672	120.530	455.221	120.624	457.773	120.722	460.326	120.823	462.882	120.929	465.440	121.040	468.000	121.154	600	
500	371.287	100.242	373.831	100.324	376.377	100.411	378.926	100.504	381.477	100.601	384.031	100.704	386.587	100.811	389.146	100.923	391.708	101.041	394.271	101.163	396.837	101.290	399.406	101.422	401.977	101.559	500	
400	305.182	80.481	307.726	80.584	310.293	80.693	312.854	80.809	315.417	80.930	317.984	81.058	320.553	81.192	323.126	81.333	325.701	81.479	328.280	81.632	330.861	81.791	333.445	81.956	336.033	82.128	400	
366	278.752	72.802	281.312	72.716	283.872	72.837	286.442	72.966	289.012	73.101	291.585	73.243	294.162	73.392	296.742	73.548	299.325	73.710	301.911	73.880	304.501	74.057	307.094	74.240	309.690	74.430	366	100 (P)*
350	272.140	70.623	274.708	70.752	277.275	70.877	279.841	71.009	282.413	71.148	284.989	71.294	287.567	71.448	290.149	71.608	292.734	71.775	295.323	71.949	297.915	72.131	300.510	72.320	303.109	72.516	350	
300	239.130	60.827	241.701	60.904	244.276	61.109	246.855	61.263	249.438	61.425	252.024	61.595	254.615	61.774	257.209	61.961	259.807	62.156	262.409	62.360	265.015	62.571	267.624	62.791	270.237	63.020	300	
250	206.141	51.079	208.727	51.244	211.313	51.418	213.908	51.603	216.506	51.797	219.108	52.001	221.715	52.215	224.326	52.439	226.941	52.673	229.561	52.917	232.185	53.171	234.813	53.434	237.445	53.708	250	
230	192.960	47.206	195.550	47.385	198.146	47.574	200.747	47.775	203.352	47.986	205.962	48.208	208.577	48.440	211.196	48.684	213.820	48.938	216.449	49.203	219.082	49.478	221.719	49.764	224.360	50.061	230	80 (P)*
200	173.205	41.438	175.808	41.643	178.416	41.861	181.030	42.091	183.649	42.334	186.273	42.589	188.903	42.856	191.537	43.135	194.177	43.427	196.821	43.731	199.470	44.047	202.124	44.376	204.783	44.716	200	
170	153.483	35.742	156.102	35.984	158.726	36.240	161.357	36.510	163.994	36.795	166.636	37.094	169.285	37.408	171.939	37.736	174.598	38.078	177.263	38.435	179.932	38.806	182.607	39.191	185.287	39.591	170	
155	143.640	32.935	146.268	33.200	148.903	33.480	151.544	33.776	154.192	34.088	156.846	34.416	159.505	34.760	162.171	35.119	164.842	35.494	167.519	35.885	170.201	36.291	172.889	36.712	175.581	37.149	155	65 (P)*
125	124.006	27.450	126.660	27.777	129.321	28.123	131.989	28.490	134.664	28.875	137.346	29.280	140.034	29.704	142.728	30.147	145.429	30.610	148.135	31.091	150.847	31.591	153.564	32.110	156.286	32.648	125	
100	107.731	23.100	110.414	23.507	113.104	23.939	115.802	24.394	118.508	24.873	121.221	25.375	123.940	25.902	126.665	26.451	129.396	27.024	132.133	27.620	134.875	28.239	137.621	28.880	140.372	29.544	100	
90	101.255	21.457	103.952	21.908	106.657	22.385	109.370	22.889	112.090	23.419	114.817	23.975	117.551	24.557	120.290	25.165	123.035	25.797	125.785	26.455	128.539	27.138	131.297	27.846	134.059	28.578	90	50 (P)
80	94.806	19.898	97.520	20.404	100.241	20.939	102.970	21.503	105.706	22.096	108.449	22.717	111.197	23.368	113.951	24.046	116.709	24.752	119.471	25.486	122.237	26.246	125.006	27.034	127.777	27.849	80	50 (H)**
70	88.193	18.460	91.124	19.034	93.864	19.642	96.610	20.282	99.362	20.954	102.120	21.658	104.883	22.393	107.649	23.160	110.419	23.958	113.191	24.785	115.965	25.643	118.739	26.536	121.514	27.446	70	
60	82.023	17.198	84.774	17.862	87.532	18.564	90.295	19.302	93.062	20.077	95.833	20.887	98.606	21.732	101.380	22.612	104.155	23.525	106.929	24.472	109.702	25.451	112.472	26.462	115.238	27.504	60	40 (P)*
55	78.858	16.662	81.618	17.382	84.384	18.142	87.154	18.940	89.926	19.778	92.701	20.653	95.476	21.565	99.250	22.513	101.022	23.496	103.791	24.514	106.556	25.566	109.315	26.651	112.068	27.767	55	
50	75.706	16.212	78.475	16.997	81.247	17.825	84.021	18.694	86.796	19.604	89.570	20.554	92.342	21.543	95.110	22.569	97.873	23.633	100.630	24.732	103.378	25.865	106.118	27.032	108.847	28.232	50	40 (H)**
45	72.568	15.873	75.342	16.736	78.116	17.644	80.890	18.596	83.662	19.591	86.429	20.628	89.189	21.705	91.942	22.822	94.685	23.976	97.417	25.166	100.136	26.391	102.840	27.650	105.529	28.940	45	35 (P)*
40	69.437	15.683	72.211	16.618	74.981	17.641	77.746	18.691	80.504	19.785	83.251	20.923	85.987	22.102	88.708	23.321	91.414	24.578	94.101	25.870							40	30 (H)**
35	66.300	15.694	69.063	16.760	71.816	17.877	74.556	19.041	77.280	20.252	79.987	21.506															35	
33	65.038	15.771	67.790	16.888	70.530	18.055	73.252	19.271	75.955	20.532																	33	30 (P)*
30	63.123	15.984	65.852	17.183	68.560	18.433																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P – Plain & Rolling Terrain **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 68 Degrees

$\Delta = 68°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metres																											metres	
2500	1603.772	515.549	1696.374	515.552	1698.777	515.557	1701.280	515.562	1703.784	515.569	1706.288	515.576	1708.792	515.585	1711.298	515.595	1713.804	515.605	1716.310	515.617	1718.817	515.629	1721.325	515.643	1723.833	515.657	2500	
2200	1491.420	453.684	1493.923	453.688	1496.425	453.693	1498.929	453.700	1501.433	453.707	1503.938	453.716	1506.443	453.725	1508.949	453.736	1511.456	453.748	1513.964	453.761	1516.471	453.776	1518.980	453.791	1521.489	453.807	2200	
2000	1356.519	412.441	1359.021	412.446	1361.525	412.451	1364.029	412.458	1366.533	412.467	1369.038	412.476	1371.544	412.487	1374.051	412.498	1376.558	412.511	1379.066	412.526	1381.575	412.542	1384.084	412.559	1386.594	412.577	2000	
1800	1221.618	371.195	1224.121	371.203	1226.624	371.209	1229.128	371.217	1231.633	371.226	1234.139	371.237	1236.646	371.249	1239.153	371.262	1241.661	371.277	1244.170	371.292	1246.680	371.310	1249.190	371.329	1251.701	371.349	1800	
1500	1019.266	309.334	1021.770	309.340	1024.274	309.348	1026.779	309.357	1029.285	309.368	1031.792	309.380	1034.300	309.394	1036.808	309.410	1039.318	309.428	1041.829	309.448	1044.341	309.468	1046.853	309.491	1049.366	309.515	1500	
1200	816.915	247.471	819.419	247.478	821.924	247.488	824.431	247.499	826.938	247.512	829.447	247.529	831.957	247.546	834.468	247.566	836.980	247.588	839.493	247.612	842.008	247.638	844.523	247.667	847.040	247.697	1200	
1000	682.014	206.229	684.519	206.238	687.026	206.249	689.533	205.263	692.042	206.279	694.553	206.298	697.064	206.320	699.578	206.344	702.092	206.370	704.608	206.399	707.125	206.430	709.644	206.464	712.164	206.500	1000	
900	614.564	185.609	617.070	185.618	619.577	185.631	622.085	185.646	624.595	185.664	627.107	185.685	629.620	185.709	632.135	185.736	634.651	185.765	637.168	185.797	639.688	185.832	642.208	185.870	644.731	185.910	900	
800	547.114	164.988	549.620	164.999	552.128	165.011	554.638	165.031	557.149	165.051	559.662	165.075	562.177	165.101	564.693	165.131	567.212	165.164	569.731	165.200	572.253	165.240	574.776	165.282	577.301	165.328	800	
700	479.665	144.369	482.172	144.381	484.680	144.397	487.191	144.417	489.705	144.440	492.219	144.467	494.736	144.498	497.255	144.532	499.775	144.570	502.298	144.611	504.823	144.656	507.349	144.704	509.878	144.756	700	100 (P)*
600	412.215	123.750	414.724	123.764	417.234	123.783	419.747	123.806	422.261	123.833	424.779	123.865	427.299	123.900	429.820	123.940	432.344	123.984	434.871	124.032	437.399	124.085	439.930	124.141	442.463	124.202	600	
500	344.767	103.132	347.276	103.149	349.789	103.172	352.304	103.199	354.822	103.232	357.341	103.270	359.866	103.312	362.392	103.360	364.921	103.413	367.453	103.471	369.987	103.533	372.524	103.601	375.063	103.674	500	
450	277.319	82.515	279.831	82.537	282.347	82.566	284.866	82.600	287.388	82.641	289.914	82.688	292.443	82.741	294.976	82.801	297.511	82.867	300.051	82.939	302.593	83.018	305.138	83.103	307.687	83.194	450	
400	250.340	74.270	252.854	74.294	255.371	74.326	257.892	74.364	260.417	74.409	262.946	74.462	265.478	74.521	268.014	74.587	270.554	74.661	273.097	74.741	275.644	74.828	278.194	74.922	280.748	75.023	400	
350	243.596	72.208	246.110	72.234	248.627	72.266	251.149	72.305	253.673	72.352	256.204	72.406	258.737	72.467	261.274	72.535	263.815	72.611	266.359	72.693	268.908	72.783	271.459	72.879	274.015	72.984	350	80 (P)*
300	209.873	61.903	212.390	61.932	214.910	61.970	217.435	62.016	219.965	62.071	222.499	62.133	225.038	62.205	227.581	62.284	230.128	62.372	232.679	62.468	235.235	62.573	237.795	62.686	240.359	62.807	300	
250	176.152	51.600	178.671	51.635	181.196	51.680	183.726	51.735	186.262	51.801	188.803	51.876	191.348	51.961	193.900	52.057	196.456	52.162	199.017	52.278	201.583	52.403	204.155	52.539	206.731	52.684	250	
230	162.664	47.479	165.183	47.518	167.712	47.567	170.245	47.627	172.781	47.698	175.327	47.780	177.877	47.873	180.432	47.976	182.993	48.091	185.559	48.216	188.131	48.353	190.708	48.500	193.290	48.658	230	
200	142.433	41.300	144.957	41.344	147.488	41.401	150.025	41.470	152.569	41.551	155.120	41.645	157.677	41.752	160.240	41.871	162.809	42.003	165.385	42.147	167.966	42.304	170.554	42.474	173.147	42.655	200	65 (P)*
170	122.203	35.124	124.731	35.175	127.267	35.243	129.811	35.323	132.363	35.419	134.922	35.530	137.488	35.655	140.061	35.796	142.642	35.951	145.230	36.120	147.824	36.304	150.426	36.503	153.034	36.717	170	
155	112.089	32.037	114.620	32.093	117.159	32.166	119.707	32.255	122.263	32.361	124.828	32.482	127.400	32.620	129.980	32.774	132.568	32.944	135.163	33.130	137.766	33.332	140.376	33.550	142.993	33.784	155	
125	81.863	25.868	84.401	25.938	86.950	26.028	89.509	26.139	92.077	26.269	94.656	26.420	97.243	26.590	99.841	26.781	102.448	26.991	105.064	27.222	107.688	27.472	110.321	27.742	112.962	28.032	125	
100	73.013	20.735	75.490	20.821	80.120	20.926	82.692	21.074	85.277	21.237	87.873	21.425	90.481	21.638	93.100	21.875	95.729	22.138	98.370	22.425	101.020	22.737	103.679	23.074	106.349	23.435	100	
90	64.274	18.685	70.826	18.783	73.393	18.908	75.973	19.062	78.566	19.245	81.172	19.457	83.790	19.698	86.420	19.972	89.062	20.243	91.715	20.562	94.378	20.908	97.052	21.281	99.735	21.681	90	50 (P)*
80	57.537	16.639	64.096	16.749	66.670	16.890	69.259	17.062	71.862	17.266	74.480	17.500	77.111	17.766	79.755	18.063	82.411	18.390	85.079	18.748	87.758	19.136	90.448	19.555	93.148	20.004	80	50 (H)**
70	50.803	14.597	57.369	14.722	59.933	14.883	62.553	15.090	65.170	15.313	67.802	15.581	70.448	15.884	73.109	16.222	75.783	16.595	78.469	17.003	81.167	17.445	83.876	17.922	86.595	18.433	70	
60	48.072	12.561	50.648	12.708	53.245	12.896	55.860	13.125	58.493	13.396	61.143	13.708	63.809	14.061	66.490	14.454	69.185	14.888	71.893	15.362	74.614	15.875	77.345	16.428	80.086	17.020	60	40 (P)*
55	44.708	11.547	47.291	11.705	49.895	11.912	52.520	12.162	55.163	12.457	57.824	12.797	60.502	13.181	63.195	13.610	65.902	14.082	68.623	14.597	71.356	15.155	74.099	15.755	76.851	16.398	55	
50	41.346	10.537	43.937	10.712	46.550	10.928	49.185	11.213	51.840	11.537	54.513	11.910	57.204	12.332	59.911	12.802	62.632	13.319	65.367	13.883	68.112	14.494	70.868	15.151	73.632	15.853	50	40 (H)**
45	37.986	9.531	40.588	9.726	43.210	9.976	45.852	10.284	48.526	10.661	51.214	11.054	53.920	11.521	56.642	12.041	59.378	12.614	62.127	13.237	64.886	13.912	67.654	14.636	70.429	15.409	45	35 (P)*
40	34.629	8.531	37.240	8.750	39.827	9.031	42.539	9.374	45.224	9.777	47.929	10.241	50.652	10.765	53.391	11.346	56.143	11.986	58.906	12.683	61.678	13.434	64.456	14.240	67.239	15.099	40	35 (H) 30 (P)*
35	31.277	7.540	33.901	7.790	36.558	8.111	39.234	8.502	41.938	8.961	44.662	9.489	47.403	10.083	50.160	10.743	52.928	11.467	55.704	12.254	58.486	13.101	61.270	14.008	64.054	14.972	35	
33	29.937	7.147	32.568	7.412	35.229	7.752	37.917	8.166	40.629	8.652	43.361	9.240	46.111	9.939	48.874	10.536	51.648	11.300	54.428	12.129	57.212	13.022	59.996	13.975	62.777	14.988	33	
30	27.930	6.563	30.572	6.854	33.245	7.227	35.947	7.681	38.672	8.214	41.418	8.825	44.179	9.512	46.952	10.272	49.733	11.105	52.517	12.007	55.301	12.975	58.080	14.008	60.850	15.101	30	30 (H)**
25	24.592	5.600	27.257	5.955	29.956	6.401	32.683	6.942	35.434	7.535	38.202	8.299	40.981	9.111	43.764	10.006	46.547	10.981	49.324	12.032	52.088	13.155	54.835	14.345	57.558	15.597	25	
23	23.261	5.233	25.936	5.611	28.647	6.094	31.387	6.680	34.148	7.365	36.923	8.146	39.706	9.020	42.490	9.981	45.267	11.026	48.032	12.149	50.776	13.344	53.495	14.607			23	25 (P)*
20	21.270	4.687	23.964	5.121	26.695	5.673	29.453	6.341	32.228	7.120	35.011	8.005	37.794	8.999	40.567	10.098	43.320	11.233	46.047	12.378							20	25 (H)**
15	17.933	3.840	20.709	4.412	23.476	5.116	26.259	6.003	29.040	7.004	31.804	8.126	34.535	9.358													15	20 (P)*
14	17.319	3.687	20.064	4.297	22.838	5.008	25.622	5.989	28.397	7.047	31.145	8.230															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 68 Degrees

$\Delta = 68°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_r	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	1726.342	313.613	1728.851	315.690	1731.360	315.707	1733.871	315.726	1736.382	315.746	1738.893	315.766	1741.405	315.788	1743.917	315.810	1746.430	315.834	1748.944	315.859	1751.458	315.884	1753.973	315.911	1756.489	315.938	2500	
2200	1523.999	453.825	1526.509	453.844	1529.020	453.864	1531.532	453.885	1534.044	453.908	1536.557	453.931	1539.071	453.956	1541.585	453.981	1544.100	454.008	1546.615	454.036	1549.131	454.065	1551.648	454.095	1554.165	454.127	2200	
2000	1389.105	412.596	1391.617	412.617	1394.129	412.639	1396.642	412.662	1399.155	412.687	1401.670	412.713	1404.185	412.740	1406.700	412.768	1409.217	412.797	1411.733	412.828	1414.251	412.860	1416.770	412.894	1419.288	412.928	2000	
1800	1254.213	371.371	1256.726	371.394	1259.240	371.418	1261.754	371.444	1264.269	371.471	1266.785	371.500	1269.302	371.530	1271.819	371.561	1274.337	371.594	1276.856	371.628	1279.375	371.664	1281.896	371.701	1284.417	371.739	1800	
1500	1051.881	309.541	1054.396	309.569	1056.913	309.598	1059.429	309.629	1061.947	309.662	1064.466	309.696	1066.986	309.732	1069.507	309.770	1072.028	309.809	1074.551	309.850	1077.074	309.893	1079.599	309.937	1082.124	309.983	1500	
1200	849.558	247.729	852.077	247.764	854.597	247.801	857.118	247.839	859.641	247.880	862.164	247.923	864.689	247.968	867.213	248.015	869.742	248.064	872.270	248.116	874.799	248.169	877.329	248.225	879.861	248.282	1200	
1000	714.686	206.359	717.208	206.581	719.733	206.625	722.258	206.671	724.785	206.720	727.313	206.772	729.842	206.826	732.373	206.882	734.906	206.941	737.439	207.003	739.974	207.067	742.510	207.134	745.047	207.203	1000	
900	647.254	185.954	649.780	186.000	652.306	186.048	654.834	186.100	657.364	186.154	659.896	186.211	662.428	186.271	664.962	186.334	667.498	186.400	670.035	186.468	672.573	186.540	675.113	186.614	677.655	186.690	900	
800	579.828	165.376	582.356	165.428	584.886	165.483	587.418	165.541	589.951	165.602	592.486	165.667	595.023	165.734	597.561	165.805	600.101	165.879	602.643	165.956	605.185	166.036	607.730	166.119	610.277	166.205	800	
700	512.408	144.812	514.940	144.871	517.475	144.934	520.010	145.000	522.549	145.070	525.088	145.144	527.630	145.221	530.174	145.302	532.719	145.386	535.266	145.474	537.815	145.565	540.366	145.661	542.919	145.759	700	
650	444.999	124.267	447.526	124.336	450.076	124.409	452.617	124.487	455.162	124.568	457.708	124.654	460.256	124.744	462.806	124.838	465.359	124.937	467.914	125.039	470.471	125.146	473.030	125.257	475.591	125.372	650	
600	377.605	103.752	380.150	103.835	382.697	103.923	385.247	104.016	387.799	104.114	390.354	104.217	392.912	104.324	395.472	104.438	398.034	104.556	400.599	104.678	403.167	104.807	405.737	104.940	408.309	105.078	600	
500	310.229	83.291	312.795	83.395	315.353	83.504	317.915	83.621	320.479	83.743	323.047	83.872	325.618	84.006	328.192	84.146	330.769	84.295	333.349	84.449	335.932	84.609	338.518	84.775	341.108	84.947	500	
460	285.306	75.132	287.867	75.246	290.431	75.369	293.000	75.498	295.571	75.633	298.146	75.777	300.724	75.927	303.305	76.083	305.890	76.247	308.479	76.417	311.071	76.595	313.667	76.780	316.263	76.971	460	100 (P)*
450	276.534	73.095	279.137	73.213	281.700	73.339	284.273	73.471	286.846	73.611	289.423	73.758	292.003	73.912	294.587	74.073	297.174	74.242	299.765	74.417	302.359	74.600	304.956	74.790	307.556	74.987	450	
400	242.928	62.937	245.500	63.075	248.077	63.221	250.657	63.376	253.242	63.539	255.831	63.710	258.423	63.890	261.019	64.078	263.620	64.274	266.224	64.479	268.831	64.692	271.443	64.913	274.058	65.143	400	
350	209.312	52.840	211.897	53.005	214.488	53.181	217.083	53.366	219.683	53.562	222.287	53.767	224.896	53.983	227.510	54.208	230.127	54.443	232.750	54.689	235.376	54.944	238.007	55.209	240.642	55.484	350	
300	175.746	42.850	178.351	43.026	180.962	43.275	183.578	43.507	186.200	43.751	188.827	44.007	191.459	44.276	194.096	44.557	196.739	44.851	199.387	45.156	202.039	45.474	204.697	45.805	207.359	46.147	300	80 (P)*
270	155.649	36.945	158.270	37.186	160.897	37.446	163.531	37.718	166.171	38.004	168.816	38.305	171.468	38.621	174.125	38.951	176.788	39.295	179.457	39.654	182.130	40.027	184.809	40.415	187.493	40.817	270	
255	145.618	34.034	148.249	34.300	150.887	34.582	153.531	34.880	156.182	35.194	158.839	35.524	161.503	35.870	164.172	36.231	166.847	36.608	169.528	37.001	172.215	37.409	174.907	37.833	177.604	38.273	255	65 (P)*
225	123.611	28.341	126.268	28.670	130.933	29.019	133.604	29.387	136.284	29.775	138.970	30.182	141.662	30.609	144.361	31.055	147.067	31.520	149.778	32.004	152.495	32.507	155.218	33.029	157.946	33.570	225	
200	109.027	23.820	111.714	24.230	114.409	24.663	117.112	25.121	119.822	25.603	122.540	26.109	125.265	26.638	127.996	27.191	130.733	27.767	133.476	28.366	136.225	28.989	138.978	29.634	141.736	30.302	200	
180	102.428	22.108	105.130	22.562	107.840	23.043	110.556	23.550	113.284	24.083	116.017	24.642	118.757	25.227	121.502	25.838	124.254	26.475	127.010	27.136	129.772	27.823	132.538	28.535	135.308	29.271	180	50 (P)
160	95.858	20.482	98.577	20.991	101.304	21.529	104.039	22.096	106.781	22.693	109.530	23.318	112.285	23.972	115.046	24.654	117.811	25.364	120.581	26.102	123.355	26.868	126.132	27.660	128.912	28.480	160	50 (H)**
140	89.324	18.977	92.062	19.555	94.807	20.166	97.560	20.810	100.320	21.486	103.085	22.194	105.855	22.934	108.630	23.705	111.408	24.507	114.189	25.340	116.972	26.202	119.756	27.094	122.540	28.016	140	
120	82.836	17.859	85.594	18.318	88.359	19.023	91.129	18.766	93.905	20.545	96.684	21.360	99.466	22.210	102.250	23.095	105.038	24.013	107.829	24.966	110.601	25.951	113.382	26.967	116.159	28.016	120	40 (P)*
95	79.612	17.081	82.380	17.605	85.154	18.569	87.932	19.373	90.713	20.215	93.497	21.095	96.281	22.012	99.066	22.966	101.848	23.955	104.628	24.979	107.404	26.037	110.175	27.128	112.939	28.251	95	
90	76.403	16.399	79.189	17.389	81.961	18.221	84.734	19.096	87.529	20.011	90.313	20.967	93.095	21.961	95.874	22.994	98.648	24.063	101.416	25.169	104.177	26.349	106.929	27.483	109.670	28.689	90	40 (H)**
80	73.208	16.728	75.991	17.067	78.776	18.010	81.560	18.968	84.342	19.969	87.119	21.012	89.891	22.095	92.656	23.218	95.411	24.379	98.156	25.577	100.887	26.809	103.605	28.075	106.307	29.373	80	35 (P)*
70	70.023	16.069	72.807	16.969	75.588	17.978	78.364	19.034	81.133	20.135	83.893	21.280	86.641	22.466	89.375	23.692	92.093	24.955	94.794	26.255							70	
65	66.834	15.991	69.608	17.063	72.372	18.186	75.125	19.357	77.862	20.575	80.582	21.836															65	30 (H)**
33	65.351	16.057	68.116	17.179	71.067	18.354	73.802	19.577	76.519	20.846																	33	30 (P)*
30	63.862	16.253	66.349	17.456	69.070	18.717																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 69 Degrees

$\Delta = 69°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1725.703	533.519	1728.205	533.522	1730.708	533.527	1733.211	533.532	1735.715	533.539	1738.219	533.546	1740.724	533.555	1743.229	533.565	1745.735	533.575	1748.241	533.587	1750.749	533.599	1753.256	533.613	1755.765	533.628	2500	
2200	1519.519	469.497	1522.021	469.501	1524.524	469.507	1527.028	469.513	1529.532	469.521	1532.037	469.529	1534.543	469.539	1537.049	469.550	1539.556	469.562	1542.063	469.575	1544.571	469.590	1547.080	469.605	1549.589	469.622	2200	
2000	1382.063	426.817	1384.566	426.821	1387.069	426.827	1389.573	426.834	1392.078	426.842	1394.583	426.852	1397.089	426.863	1399.596	426.874	1402.104	426.888	1404.612	426.902	1407.121	426.918	1409.630	426.935	1412.140	426.953	2000	
1800	1244.608	384.136	1247.111	384.141	1249.614	384.147	1252.119	384.155	1254.624	384.165	1257.130	384.175	1259.636	384.187	1262.144	384.200	1264.652	384.215	1267.161	384.231	1269.671	384.249	1272.182	384.268	1274.693	384.288	1800	
1500	1038.425	320.116	1040.926	320.122	1043.432	320.129	1045.938	320.139	1048.444	320.150	1050.951	320.162	1053.458	320.177	1055.968	320.193	1058.478	320.210	1060.989	320.230	1063.500	320.251	1066.013	320.274	1068.527	320.298	1500	
1200	832.242	256.096	834.746	256.104	837.251	256.113	839.758	256.125	842.265	256.138	844.774	256.154	847.284	256.172	849.796	256.192	852.308	256.214	854.821	256.239	857.336	256.265	859.852	256.293	862.369	256.324	1200	
1000	694.787	213.417	697.292	213.426	699.798	213.437	702.306	213.451	704.815	213.468	707.326	213.487	709.838	213.508	712.351	213.532	714.866	213.558	717.382	213.587	719.900	213.619	722.419	213.653	724.939	213.690	1000	
900	626.059	192.078	628.565	192.088	631.072	192.100	633.581	192.116	636.091	192.134	638.603	192.155	641.116	192.179	643.631	192.206	646.148	192.235	648.666	192.267	651.185	192.302	653.706	192.340	656.229	192.381	900	
800	557.332	170.719	559.838	170.730	562.346	170.744	564.856	170.761	567.368	170.782	569.881	170.825	572.396	170.853	574.913	170.882	577.431	170.916	579.952	170.952	582.474	170.991	584.997	171.034	587.523	171.080	800	100 (P)*
700	488.605	149.400	491.113	149.413	493.621	149.429	496.133	149.449	498.646	149.472	501.161	149.500	503.678	149.530	506.197	149.564	508.718	149.602	511.242	149.644	513.767	149.689	516.294	149.738	518.823	149.790	700	
600	419.879	128.062	422.387	128.077	424.898	128.096	427.411	128.119	429.926	128.146	432.444	128.178	434.964	128.214	437.486	128.254	440.010	128.298	442.538	128.347	445.067	128.399	447.598	128.456	450.132	128.517	600	
500	351.153	106.726	353.663	106.743	356.176	106.766	358.691	106.794	361.209	106.827	363.731	106.865	366.255	106.907	368.781	106.956	371.311	107.009	373.843	107.067	376.377	107.130	378.915	107.198	381.455	107.271	500	
460	282.428	85.391	284.940	85.413	287.456	85.441	289.976	85.476	292.499	85.517	295.025	85.565	297.555	85.618	300.088	85.678	302.624	85.744	305.164	85.817	307.707	85.896	310.254	85.981	312.804	86.073	400	
360	254.939	76.858	257.452	76.882	259.970	76.914	262.492	76.952	265.017	76.998	267.546	77.051	270.079	77.110	272.616	77.177	275.156	77.251	277.700	77.331	280.248	77.419	282.800	77.514	285.355	77.616	360	
350	248.066	74.725	250.581	74.750	253.099	74.782	255.621	74.822	258.147	74.869	260.677	74.923	263.211	74.984	265.748	75.053	268.290	75.129	270.835	75.212	273.384	75.302	275.937	75.399	278.494	75.504	350	80 (P)*
300	213.705	64.060	216.222	64.089	218.743	64.122	221.269	64.173	223.799	64.228	226.334	64.291	228.873	64.363	231.417	64.443	233.965	64.531	236.518	64.628	239.075	64.734	241.636	64.847	244.201	64.969	300	
250	179.346	53.397	181.865	53.433	184.391	53.478	186.921	53.533	189.457	53.599	191.999	53.675	194.546	53.761	197.098	53.857	199.655	53.963	202.218	54.079	204.785	54.205	207.358	54.342	209.936	54.488	250	
230	165.602	49.133	168.124	49.171	170.651	49.221	173.184	49.281	175.724	49.353	178.269	49.435	180.819	49.528	183.376	49.633	185.938	49.748	188.505	49.874	191.078	50.011	193.657	50.159	196.241	50.319	230	
200	144.988	42.788	147.512	42.782	150.044	42.839	152.582	42.909	155.127	42.991	157.678	43.085	160.236	43.193	162.801	43.313	165.372	43.445	167.949	43.590	170.532	43.748	173.121	43.918	175.717	44.101	200	65 (P)*
170	124.375	36.346	126.904	36.398	129.441	36.465	131.985	36.547	134.538	36.643	137.098	36.755	139.665	36.881	142.240	37.022	144.823	37.178	147.412	37.348	150.009	37.534	152.612	37.734	155.223	37.949	170	
155	114.069	33.531	116.601	33.598	119.141	33.682	121.690	33.771	124.247	33.877	126.813	33.999	129.386	34.138	131.968	34.293	134.558	34.463	137.155	34.651	139.760	34.854	142.373	34.673	144.992	34.909	155	
125	93.681	26.767	95.999	26.837	98.599	26.928	101.109	27.040	103.679	27.171	106.259	27.322	108.849	27.494	111.449	27.685	114.058	27.897	116.676	28.129	119.303	28.380	121.938	28.652	124.582	28.944	125	
100	76.291	21.424	78.839	21.543	81.400	21.656	83.974	21.795	86.561	21.959	89.159	22.148	91.769	22.363	94.390	22.602	97.023	22.866	99.666	23.155	102.319	23.469	104.983	23.807	107.656	24.170	100	
90	69.425	19.333	71.978	19.431	74.546	19.557	77.127	19.712	79.722	19.894	82.331	20.104	84.951	20.342	87.584	20.607	90.229	20.900	92.885	21.221	95.553	21.569	98.230	21.944	100.918	22.347	90	50 (P)*
80	62.561	17.215	65.120	17.325	67.696	17.467	70.287	17.641	72.892	17.845	75.512	18.081	78.146	18.349	80.793	18.647	83.453	18.976	86.125	19.336	88.808	19.727	91.502	20.148	94.207	20.600	80	50 (H)**
70	55.699	15.101	58.266	15.227	60.852	15.389	63.454	15.587	66.073	15.821	68.708	16.091	71.358	16.396	74.022	16.736	76.699	17.111	79.390	17.522	82.093	17.967	84.807	18.446	87.531	18.960	70	
60	48.840	12.964	51.416	13.141	54.017	13.330	56.634	13.561	59.270	13.833	61.924	14.147	64.593	14.502	67.279	14.898	69.978	15.334	72.691	15.811	75.417	16.327	78.154	16.883	80.901	17.479	60	40 (P)*
55	45.413	11.944	47.997	12.105	50.604	12.311	53.231	12.562	55.877	12.859	58.542	13.201	61.224	13.588	63.921	14.019	66.634	14.493	69.360	15.012	72.098	15.573	74.848	16.177	77.607	16.823	55	
50	41.987	10.898	44.579	11.074	47.195	11.301	49.833	11.577	52.491	11.904	55.169	12.279	57.864	12.703	60.576	13.176	63.303	13.696	66.043	14.264	68.795	14.879	71.558	15.539	74.329	16.245	50	40 (H)**
45	38.564	9.856	41.165	10.052	43.792	10.304	46.443	10.610	49.115	10.972	51.808	11.388	54.519	11.858	57.246	12.381	59.988	12.957	62.744	13.584	65.510	14.263	68.285	14.991	71.068	15.769	45	35 (P)*
40	35.143	8.820	37.756	9.041	40.397	9.323	43.062	9.668	45.751	10.074	48.461	10.541	51.189	11.067	53.934	11.652	56.695	12.296	59.464	12.996	62.243	13.752	65.030	14.563	67.822	15.427	40	35 (H) 30 (P)*
35	31.727	7.794	34.354	8.045	37.011	8.368	39.695	8.761	42.403	9.223	45.133	9.754	47.881	10.352	50.644	11.015	53.420	11.744	56.204	12.535	58.995	13.388	61.789	14.300	64.583	15.270	35	
33	30.362	7.386	32.996	7.653	35.660	7.995	38.353	8.411	41.070	8.900	43.808	9.462	46.564	10.094	49.335	10.795	52.117	11.564	54.906	12.398	57.699	13.296	60.493	14.255	63.289	15.274	33	
30	28.317	6.781	30.962	7.074	33.639	7.449	36.346	7.905	39.077	8.442	41.829	9.056	44.598	9.747	47.379	10.512	50.168	11.350	52.962	12.257	55.756	13.231	58.546	14.270	61.327	15.370	30	30 (H)**
25	24.916	5.789	27.584	6.139	30.288	6.588	33.022	7.132	35.779	7.770	38.554	8.498	41.342	9.314	44.135	10.214	46.928	11.195	49.716	12.252	52.492	13.382	55.252	14.579	57.988	15.839	25	
23	23.560	5.401	26.239	5.782	28.955	6.268	31.701	6.857	34.469	7.546	37.253	8.332	40.045	9.211	42.839	10.178	45.628	11.228	48.403	12.358	51.161	13.561	53.893	14.831			23	25 (P)*
20	21.531	4.834	24.230	5.270	26.967	5.826	29.732	6.498	32.515	7.282	35.308	8.171	38.101	9.162	40.885	10.247	43.651	11.419	46.391	12.671							20	25 (H)**
15	18.173	3.953	20.914	4.528	23.689	5.256	26.481	6.129	29.273	7.135	32.049	8.264	34.793	9.503													15	20 (P)*
14	17.506	3.792	20.258	4.406	23.040	5.182	25.833	6.108	28.619	7.173	31.380	8.362															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 69 Degrees

$\Delta = 69°$

Rc	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		Rc	Speed km/h
	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S		
metre																											metre	
2500	1758.273	333.644	1760.783	332.660	1763.293	333.678	1765.803	333.697	1768.314	333.716	1770.826	333.737	1773.338	333.759	1775.851	333.781	1778.364	333.805	1780.878	333.830	1783.393	333.856	1785.907	333.883	1788.423	333.910	2500	
2200	1552.099	469.639	1554.610	469.658	1557.121	469.678	1559.633	469.700	1562.146	469.722	1564.659	469.746	1567.173	469.771	1569.687	469.796	1572.202	469.823	1574.718	469.851	1577.234	469.881	1579.751	469.911	1582.269	469.943	2200	
2000	1414.651	426.973	1417.163	426.994	1419.676	427.016	1422.188	427.039	1424.702	427.064	1427.217	427.090	1429.732	427.117	1432.248	427.145	1434.765	427.175	1437.282	427.206	1439.800	427.238	1442.319	427.272	1444.838	427.307	2000	
1800	1277.205	384.310	1279.719	384.333	1282.232	384.358	1284.747	384.384	1287.262	384.411	1289.778	384.440	1292.295	384.470	1294.813	384.501	1297.331	384.534	1299.850	384.569	1302.370	384.605	1304.891	384.642	1307.413	384.680	1800	
1600	1071.042	320.324	1073.557	320.352	1076.074	320.382	1078.591	320.413	1081.109	320.446	1083.628	320.480	1086.149	320.516	1088.670	320.554	1091.192	320.594	1093.715	320.635	1096.239	320.678	1098.763	320.722	1101.289	320.769	1600	
1200	864.887	256.356	867.407	256.391	869.927	256.428	872.449	256.467	874.972	256.508	877.496	256.551	880.021	256.597	882.547	256.644	885.075	256.693	887.604	256.745	890.133	256.799	892.664	256.854	895.196	256.912	1200	
1000	727.461	213.729	729.985	213.771	732.509	213.815	735.035	213.862	737.563	213.911	740.091	213.963	742.621	214.017	745.153	214.074	747.685	214.134	750.219	214.195	752.755	214.260	755.292	214.327	757.830	214.396	1000	
900	658.753	192.425	661.279	192.471	663.806	192.520	666.335	192.572	668.865	192.627	671.397	192.684	673.930	192.745	676.465	192.808	679.001	192.874	681.539	192.943	684.079	193.014	686.619	193.089	689.162	193.166	900	
800	590.050	171.129	592.579	171.181	595.109	171.236	597.642	171.295	600.176	171.356	602.711	171.421	605.249	171.489	607.788	171.560	610.328	171.634	612.871	171.712	615.415	171.792	617.960	171.876	620.508	171.963	800	
700	521.354	149.846	523.886	149.906	526.421	149.969	528.958	150.036	531.497	150.106	534.037	150.180	536.580	150.258	539.124	150.339	541.670	150.424	544.219	150.512	546.769	150.604	549.321	150.700	551.874	150.799	700	
600	452.668	128.583	455.206	128.652	457.746	128.720	460.289	128.804	462.834	128.886	465.381	128.972	467.930	129.063	470.482	129.157	473.035	129.257	475.591	129.360	478.149	129.467	480.709	129.578	483.271	129.694	600	
500	383.998	107.350	386.543	107.433	389.092	107.522	391.643	107.615	394.196	107.714	396.752	107.817	399.311	107.926	401.872	108.040	404.436	108.158	407.002	108.282	409.571	108.411	412.142	108.544	414.716	108.683	500	
400	315.357	86.171	317.913	86.275	320.473	86.383	323.036	86.502	325.601	86.625	328.171	86.755	330.743	86.891	333.319	87.033	335.897	87.181	338.479	87.335	341.064	87.496	343.652	87.663	346.242	87.837	400	
360	287.913	77.725	290.476	77.840	293.042	77.963	295.611	78.093	298.184	78.229	300.760	78.373	303.340	78.524	305.923	78.682	308.510	78.846	311.100	79.018	313.693	79.197	316.290	79.382	318.890	79.575	360	100 (P)*
350	281.034	75.616	283.618	75.735	286.186	75.861	288.757	75.995	291.332	76.135	293.910	76.283	296.492	76.438	299.077	76.601	301.666	76.770	304.259	76.946	306.854	77.130	309.454	77.321	312.056	77.519	350	
300	240.771	65.100	243.343	65.238	251.923	65.383	254.505	65.542	257.091	65.703	259.682	65.878	262.276	66.058	264.875	66.248	267.477	66.445	270.083	66.651	272.693	66.865	275.307	67.087	277.925	67.319	300	
250	212.518	54.645	215.106	54.811	217.698	54.988	220.295	55.174	222.897	55.371	225.504	55.578	228.115	55.794	230.731	56.021	233.351	56.258	235.976	56.504	238.605	56.761	241.239	57.028	243.876	57.304	250	
230	198.830	50.489	201.425	50.669	204.024	50.861	206.629	51.064	209.239	51.278	211.854	51.502	214.473	51.738	217.098	51.984	219.727	52.241	222.361	52.509	225.000	52.788	227.643	53.077	230.291	53.377	230	80 (P)*
200	178.318	44.297	180.925	44.505	183.538	44.725	186.156	44.958	188.781	45.203	191.410	45.461	194.046	45.732	196.686	46.014	199.332	46.310	201.983	46.617	204.639	46.937	207.299	47.270	209.965	47.614	200	
170	157.840	38.170	160.464	38.423	163.094	38.682	165.730	38.956	168.373	39.244	171.022	39.547	173.677	39.864	176.338	40.196	179.004	40.543	181.676	40.904	184.354	41.279	187.037	41.669	189.726	42.073	170	
155	147.619	35.100	150.253	35.428	152.894	35.772	155.542	36.012	158.196	36.328	160.857	36.659	163.524	37.007	166.197	37.371	168.876	37.750	171.561	38.145	174.252	38.556	176.948	38.982	179.650	39.425	155	65 (P)*
125	127.235	29.255	129.895	29.586	132.563	29.937	135.239	30.307	137.922	30.697	140.613	31.107	143.310	31.536	146.014	31.985	148.724	32.452	151.441	32.939	154.163	33.446	156.891	33.971	159.625	34.515	125	
110	110.338	24.558	113.029	24.970	115.729	25.406	118.437	25.867	121.152	26.352	123.876	26.860	126.606	27.392	129.343	27.949	132.086	28.528	134.836	29.131	137.590	29.757	140.351	30.406	143.116	31.078	100	
90	103.615	22.777	106.322	23.233	109.037	23.716	111.761	24.226	114.492	24.763	117.231	25.325	119.977	25.914	122.729	26.528	125.487	27.169	128.251	27.834	131.020	28.525	133.793	29.241	136.571	29.982	90	50 (P)
80	96.922	21.081	99.646	21.595	102.379	22.134	105.120	22.705	107.868	23.305	110.624	23.934	113.386	24.592	116.154	25.278	118.927	25.992	121.705	26.735	124.487	27.505	127.272	28.302	130.061	29.126	80	50 (H)**
70	90.266	19.307	93.010	20.089	95.762	20.703	98.522	21.351	101.288	22.031	104.061	22.743	106.839	23.488	109.622	24.263	112.409	25.070	115.198	25.908	117.990	26.776	120.784	27.673	123.578	28.600	70	
60	83.658	18.112	86.423	18.784	89.195	19.494	91.974	20.241	94.758	21.025	97.546	21.845	100.337	22.700	103.130	23.590	105.924	24.514	108.718	25.472	111.511	26.463	114.303	27.486	117.091	28.540	60	40 (P)*
55	80.375	17.511	83.151	18.239	85.933	19.008	88.719	19.816	91.510	20.663	94.303	21.549	97.097	22.471	99.891	23.431	102.684	24.426	105.475	25.456	108.262	26.520	111.044	27.618	113.821	28.747	55	
50	77.109	16.996	79.894	17.790	82.683	18.628	85.476	19.508	88.270	20.428	91.064	21.390	93.857	22.390	96.647	23.429	99.432	24.505	102.212	25.617	104.985	26.764	107.749	27.945	110.503	29.158	50	40 (H)**
45	73.857	16.594	76.649	17.467	79.443	18.386	82.237	19.349	85.029	20.356	87.818	21.405	90.602	22.495	93.378	23.623	96.146	24.793	98.903	25.997	101.648	27.237	104.379	28.510	107.094	29.816	45	35 (P)*
40	70.616	16.343	73.410	17.309	76.202	18.324	78.989	19.386	81.770	20.493	84.541	21.645	87.302	22.838	90.049	24.071	92.781	25.342	95.496	26.650							40	30 (H)**
35	67.374	16.295	70.159	17.377	72.935	18.501	75.700	19.681	78.450	20.906	81.184	22.175															36	
33	66.071	16.349	68.843	17.479	71.611	18.660	74.359	19.890	77.089	21.166																	33	30 (P)*
30	64.092	16.528	66.851	17.742	69.586	19.007																					30	30 (H)**
25																											25	25 (P)*
23																											23	
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

Δ = 70°

TABLE 19 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 70 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1758.019	351.939	1760.521	351.942	1763.024	351.947	1765.527	351.952	1768.031	351.959	1770.535	351.967	1773.040	351.975	1775.546	351.985	1778.052	351.996	1780.558	352.008	1783.065	352.020	1785.574	352.034	1788.082	352.049	2500	
2250	1547.998	485.707	1550.460	485.711	1552.963	485.717	1555.467	485.723	1557.971	485.730	1560.476	485.739	1562.981	485.749	1565.488	485.760	1567.995	485.772	1570.502	485.785	1573.010	485.800	1575.519	485.815	1578.029	485.832	2250	
2000	1407.917	441.553	1410.419	441.558	1412.922	441.563	1415.427	441.570	1417.931	441.579	1420.437	441.588	1422.943	441.599	1425.450	441.611	1427.957	441.624	1430.466	441.639	1432.975	441.655	1435.484	441.672	1437.993	441.690	2000	
1800	1267.875	397.399	1270.378	397.404	1272.882	397.410	1275.386	397.418	1277.892	397.427	1280.398	397.438	1282.905	397.450	1285.412	397.463	1287.921	397.478	1290.430	397.494	1292.940	397.512	1295.451	397.531	1297.963	397.552	1800	
1600	1057.814	331.168	1060.318	331.174	1062.822	331.182	1065.327	331.191	1067.834	331.202	1070.341	331.215	1072.849	331.229	1075.358	331.245	1077.868	331.263	1080.380	331.283	1082.892	331.304	1085.405	331.327	1087.919	331.351	1600	
1500	947.793	264.938	950.298	264.945	952.803	264.955	955.309	264.967	957.818	264.980	960.327	264.994	962.837	265.014	965.349	265.034	967.861	265.057	970.375	265.081	972.890	265.108	975.406	265.136	977.924	265.167	1500	
1400	707.713	220.785	710.218	220.794	712.723	220.806	715.233	220.820	717.742	220.836	720.253	220.855	722.765	220.877	725.279	220.901	727.794	220.927	730.311	220.957	732.829	220.989	735.348	221.023	737.869	221.060	1400	
1200	637.693	198.709	640.199	198.719	642.706	198.732	645.215	198.747	647.725	198.765	650.238	198.787	652.751	198.811	655.266	198.838	657.783	198.867	660.302	198.900	662.822	198.935	665.343	198.973	667.866	199.014	1200	
1000	567.674	176.833	570.180	176.844	572.688	176.859	575.198	176.878	577.710	176.897	580.223	176.921	582.738	176.948	585.255	176.978	587.773	176.811	590.293	176.848	592.815	176.887	595.342	176.930	597.868	176.977	1000	
900	497.654	154.558	500.161	154.571	502.670	154.587	505.182	154.607	507.696	154.631	510.211	154.658	512.728	154.689	515.248	154.723	517.769	154.761	520.293	154.803	522.818	154.849	525.346	154.898	527.875	154.950	900	100 (P)*
800	427.635	132.483	430.144	132.498	432.654	132.517	435.167	132.541	437.683	132.568	440.201	132.600	442.721	132.636	445.244	132.676	447.769	132.720	450.297	132.770	452.826	132.823	455.358	132.880	457.893	132.941	800	
700	357.616	110.410	360.126	110.428	362.639	110.450	365.155	110.478	367.674	110.511	370.196	110.550	372.720	110.593	375.247	110.641	377.777	110.694	380.310	110.753	382.845	110.817	385.384	110.885	387.926	110.959	700	
600	287.599	88.338	290.112	88.360	292.628	88.389	295.147	88.424	297.671	88.465	300.198	88.513	302.728	88.567	305.262	88.627	307.799	88.694	310.340	88.767	312.884	88.846	315.431	88.932	317.982	89.024	600	
500	259.593	79.570	262.107	79.595	264.625	79.567	267.146	79.606	269.672	79.652	272.202	79.704	274.736	79.763	277.273	79.832	279.814	79.906	282.359	79.987	284.908	80.073	287.460	80.171	290.017	80.273	500	
450	252.591	77.303	255.105	77.329	257.624	77.362	260.146	77.402	262.673	77.449	265.203	77.503	267.738	77.563	270.276	77.634	272.819	77.710	275.365	77.794	277.915	77.885	280.469	77.982	283.027	78.088	450	
400	217.584	66.670	220.101	66.300	222.622	66.338	225.148	66.385	227.679	66.440	230.215	66.503	232.755	66.575	235.299	66.656	237.848	66.745	240.402	66.842	242.960	66.948	245.522	67.063	248.089	67.183	400	
350	182.578	55.239	185.098	55.275	187.624	55.321	190.155	55.376	192.692	55.443	195.234	55.519	197.782	55.605	200.335	55.702	202.893	55.809	205.457	55.926	208.026	56.052	210.600	56.190	213.179	56.337	350	
330	168.576	50.828	171.098	50.866	173.626	50.916	176.160	50.977	178.700	51.049	181.245	51.132	183.797	51.226	186.355	51.331	188.918	51.447	191.487	51.574	194.061	51.712	196.642	51.861	199.227	52.021	330	
300	147.574	44.213*	150.099	44.256	152.631	44.314	155.170	44.384	157.716	44.466	160.268	44.562	162.827	44.670	165.393	44.790	167.965	44.924	170.544	45.070	173.128	45.228	175.720	45.400	178.317	45.584	300	80 (P)*
270	126.573	37.599*	129.103	37.651*	131.640	37.718	134.186	37.801	136.739	37.898	139.300	38.010	141.869	38.137	144.446	38.279	147.030	38.436	149.621	38.607	152.220	38.794	154.825	38.995	157.438	39.212	270	65 (P)*
245	116.074	34.294	118.606	34.351	121.147	34.423	123.697	34.513	126.255	34.622	128.822	34.745	131.397	34.884	133.980	35.040	136.572	35.212	139.171	35.400	141.778	35.604	144.393	35.825	147.016	36.062	245	
225	95.077	27.648*	97.617	27.729	100.167	27.851	102.729	27.963	105.300	28.095	107.882	28.247	110.474	28.420	113.075	28.613	115.686	28.826	118.307	29.059	120.936	29.312	123.573	29.585	126.222	29.878	225	
200	77.585	22.192*	80.124	22.281*	82.666	22.395	85.212	22.535	87.760	22.700	90.460	22.890	93.072	23.106	95.696	23.346	98.332	23.612	100.978	23.903	103.635	24.218	106.302	24.559	108.978	24.924	200	
180	70.590	18.997	73.144	20.096	75.713	20.223	78.296	20.378	80.893	20.561	83.503	20.772	86.127	21.012	88.763	21.279	91.411	21.574	94.070	21.896	96.741	22.246	99.423	22.624	102.115	23.029	180	50 (P)*
160	63.596	17.805	66.157	17.916	68.734	18.038	71.327	18.183	73.935	18.439	76.557	18.677	79.194	18.946	81.844	19.246	84.507	19.577	87.183	19.938	89.870	20.332	92.569	20.756	95.279	21.210	160	50 (H)**
150	56.603	15.611*	59.174	15.745*	61.761	15.906	64.365	16.107	66.988	16.342	69.625	16.613	72.278	16.920	74.946	17.263	77.627	17.640	80.322	18.053	83.030	18.501	85.750	18.981	88.479	19.500	150	
140	49.610	13.437*	52.197	13.585*	54.798	13.775	57.418	14.008	60.052	14.283	62.713	14.597	65.387	14.955	68.077	15.353	70.781	15.792	73.499	16.271	76.230	16.791	78.973	17.350	81.727	17.949	140	
130	46.126	12.350*	48.712	12.482*	51.321	12.719	53.950	12.972	56.600	13.271	59.268	13.615	61.954	14.004	64.657	14.438	67.374	14.915	70.106	15.437	72.850	16.003	75.606	16.609	78.372	17.259	130	
120	42.636	11.267*	45.230	11.445	47.845	11.672	50.480	11.951	53.151	12.279	55.832	12.657	58.532	13.084	61.249	13.559	63.982	14.083	66.728	14.654	69.486	15.273	72.256	15.937	75.035	16.647	120	40 (H)**
110	39.148	10.189*	41.732	10.388*	44.341	10.638	47.035	10.948	49.711	11.312	52.408	11.731	55.124	12.203	57.857	12.730	60.606	13.308	63.368	13.940	66.141	14.623	68.924	15.355	71.716	16.138	110	35 (P)*
100	35.663	9.117*	38.279	9.338*	40.922	9.623	43.591	9.970	46.285	10.378	48.999	10.848	51.733	11.377	54.486	11.966	57.259	12.613	60.052	13.318	62.866	14.079	65.697	14.894	68.542	15.764	100	35 (H) 30 (P)*
90	32.183	8.054	34.813	8.307*	37.473	8.631	40.161	9.027	42.874	9.492	45.610	10.025	48.364	10.627	51.134	11.295	53.918	12.028	56.711	12.824	59.511	13.682	62.314	14.599	65.118	15.575	90	
80	28.709	7.004	31.357	7.299*	34.038	7.676	36.750	8.136	39.487	8.675	42.245	9.293	45.021	9.988	47.810	10.738	50.609	11.601	53.412	12.514	56.216	13.494	59.017	14.539	61.811	15.646	80	30 (H)**
75	25.244	5.976*	27.916	6.329*	30.625	6.780	33.364	7.327	36.128	7.969	38.911	8.701	41.707	9.522	44.510	10.438	47.314	11.415	50.113	12.479	52.901	13.615	55.675	14.816	58.425	16.087	75	
70	23.863	5.574*	26.546	5.956*	29.267	6.446	32.019	7.038	34.795	7.732	37.587	8.522	40.388	9.406	43.193	10.379	45.992	11.436	48.780	12.573	51.551	13.783	54.296	15.061			70	25 (P)*
60	21.796	4.982*	24.500	5.424*	27.242	5.983	30.014	6.659	32.806	7.447	35.608	8.342	38.412	9.339	41.207	10.430	43.986	11.610	46.739	12.870							60	25 (H)**
50	18.375	4.068*	21.123	4.647*	23.903	5.379*	26.700	6.257*	29.509	7.269*	32.286	8.405*	35.054	9.652*													50	20 (P)*
45	17.696	3.900*	20.454	4.318*	23.244	5.298*	26.047	6.220*	28.845	7.301*	31.618	8.498*															45	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE NO : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 70 Degrees

$\Delta = 70°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed limits
metres	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metres	
2500	1790.591	352.064	1793.100	352.081	1795.611	352.099	1798.121	352.118	1800.633	352.138	1803.145	352.159	1805.657	352.180	1808.170	352.203	1810.683	352.227	1813.196	352.252	1815.712	352.278	1818.228	352.305	1820.744	352.333	2500	
2250	1580.539	485.800	1583.099	485.869	1585.561	485.889	1588.073	485.911	1590.586	485.933	1593.100	485.957	1595.614	485.982	1598.129	486.008	1600.644	486.035	1603.160	486.063	1605.677	486.093	1608.194	486.124	1610.712	486.155	2250	
2000	1440.506	441.710	1443.018	441.751	1445.531	441.753	1448.044	441.777	1450.558	441.802	1453.073	441.828	1455.588	441.855	1458.103	441.884	1460.622	441.914	1463.139	441.945	1465.657	441.977	1468.177	442.011	1470.696	442.046	2000	
1800	1300.472	397.573	1302.988	397.597	1305.502	396.622	1308.017	397.648	1310.533	397.675	1313.049	397.704	1315.566	397.735	1318.084	397.766	1320.603	397.800	1323.123	397.834	1325.643	397.870	1328.164	397.908	1330.686	397.947	1800	
1600	1090.433	331.377	1092.949	331.406	1095.466	331.435	1097.984	331.467	1100.502	331.500	1103.022	331.534	1105.543	331.571	1108.064	331.609	1110.587	331.649	1113.110	331.690	1115.633	331.734	1118.160	331.778	1120.686	331.825	1600	
1400	880.402	265.200	882.922	265.235	885.443	265.272	887.965	265.311	890.488	265.353	893.013	265.396	895.538	265.441	898.065	265.489	900.593	265.539	903.122	265.591	905.652	265.645	908.184	265.701	910.717	265.759	1400	
1200	740.391	221.099	742.915	221.141	745.440	221.185	747.966	221.233	750.494	221.282	753.023	221.334	755.554	221.389	758.086	221.446	760.620	221.506	763.154	221.568	765.691	221.633	768.229	221.701	770.767	221.770	1200	
1000	670.391	199.038	672.917	199.103	675.445	199.154	677.974	199.206	680.505	199.261	683.037	199.319	685.571	199.380	688.107	199.444	690.644	199.510	693.182	199.579	695.722	199.651	698.264	199.726	700.807	199.804	1000	
900	600.392	177.026	602.925	177.078	605.456	177.134	607.989	177.193	610.523	177.255	613.060	177.320	615.598	177.388	618.137	177.460	620.679	177.534	623.222	177.612	625.767	177.693	628.314	177.777	630.862	177.865	900	
800	530.407	155.007	532.941	155.066	535.476	155.130	538.013	155.197	540.553	155.268	543.094	155.343	545.637	155.420	548.183	155.502	550.730	155.588	553.279	155.677	555.830	155.769	558.383	155.865	560.938	155.965	800	
700	460.429	133.007	462.964	133.077	465.499	133.151	468.035	133.229	470.573	133.312	473.146	133.399	475.697	133.490	478.249	133.585	480.804	133.685	483.361	133.788	485.920	133.896	488.481	134.009	491.045	134.125	700	
600	390.468	111.038	393.014	111.122	395.564	111.217	398.116	111.305	400.670	111.404	403.227	111.508	405.787	111.617	408.349	111.732	410.914	111.851	413.482	111.975	416.052	112.105	418.625	112.240	421.200	112.379	600	
500	320.536	89.123	323.094	89.228	325.654	89.339	328.219	89.457	330.785	89.580	333.356	89.710	335.930	89.847	338.507	89.990	341.087	90.139	343.671	90.295	346.257	90.457	348.847	90.625	351.439	90.799	500	
450	292.576	80.383	295.140	80.499	297.707	80.622	300.278	80.753	302.852	80.890	305.430	81.035	308.011	81.187	310.596	81.345	313.185	81.511	315.777	81.684	318.372	81.864	320.970	82.050	323.573	82.244	450	100 (P)*
400	285.588	78.200	288.153	78.320	290.722	78.447	293.295	78.582	295.871	78.723	298.451	78.872	301.035	79.028	303.622	79.191	306.213	79.361	308.807	79.539	311.405	79.724	314.006	79.916	316.611	80.115	400	
350	250.680	67.317	253.236	67.456	255.815	67.604	258.399	67.761	260.987	67.926	263.579	68.099	266.176	68.281	268.776	68.472	271.380	68.670	273.989	68.877	276.601	69.093	279.217	69.317	281.838	69.549	350	
320	215.764	56.694	218.353	56.862	220.947	56.840	223.546	57.027	226.150	57.225	228.759	57.433	231.373	57.651	233.991	57.879	236.614	58.117	239.241	58.365	241.873	58.624	244.509	58.892	247.150	59.170	320	
300	201.818	52.192	204.415	52.374	207.016	52.567	209.623	52.771	212.235	52.986	214.852	53.212	217.473	53.448	220.102	53.696	222.734	53.955	225.371	54.224	228.012	54.505	230.659	54.796	233.310	55.098	300	80 (P)*
280	180.920	45.780	183.530	45.989	186.145	46.211	188.766	46.445	191.393	46.692	194.025	46.952	196.663	47.224	199.307	47.508	201.956	47.805	204.610	48.115	207.269	48.437	209.934	48.771	212.603	49.118	280	
250	160.959	39.443	162.684	39.689	165.317	39.949	167.956	40.224	170.602	40.514	173.254	40.819	175.913	41.138	178.577	41.472	181.247	41.821	183.923	42.184	186.605	42.562	189.292	42.954	191.985	43.361	250	
225	149.643	36.315	152.282	36.585	154.926	36.870	157.577	37.172	160.234	37.489	162.899	37.823	165.569	38.173	168.246	38.539	170.930	38.920	173.619	39.318	176.314	39.731	179.015	40.160	181.721	40.605	225	65 (P)*
200	128.878	30.192	131.542	30.525	134.214	30.878	136.894	31.250	139.581	31.643	142.276	32.055	144.978	32.487	147.686	32.938	150.401	33.408	153.123	33.898	155.851	34.409	158.585	34.939	161.324	35.494	225	
180	111.665	25.314	114.360	25.729	117.065	26.168	119.778	26.631	122.499	27.119	125.227	27.630	127.963	28.166	130.706	28.725	133.455	29.309	136.211	29.915	138.973	30.545	141.740	31.198	144.512	31.874	180	
160	104.817	23.461	107.528	23.921	110.246	24.407	112.978	24.920	115.713	25.459	118.460	26.025	121.212	26.618	123.970	27.236	126.735	27.880	129.506	28.550	132.282	29.245	135.063	29.965	137.849	30.711	160	30 (P)
140	97.999	21.695	100.728	22.210	103.467	22.734	106.214	23.328	108.969	23.932	111.731	24.565	114.500	25.227	117.275	25.917	120.056	26.636	122.842	27.383	125.632	28.157	128.428	28.959	131.228	29.789	140	35 (H)**
120	91.220	20.051	93.970	20.636	96.728	21.254	99.495	21.905	102.269	22.590	105.049	23.306	107.835	24.055	110.626	24.836	113.421	25.648	116.220	26.490	119.021	27.363	121.824	28.266	124.628	29.199	120	
100	84.490	18.587	87.262	19.263	90.042	19.977	92.829	20.728	95.621	21.517	98.417	22.342	101.218	23.202	104.020	24.097	106.824	25.027	109.629	25.991	112.433	26.988	115.235	28.017	118.034	29.078	100	40 (P)*
90	81.148	17.951	83.931	18.684	86.726	19.457	89.516	20.270	92.316	21.123	95.118	22.013	97.922	22.942	100.727	23.907	103.530	24.908	106.332	25.945	109.130	27.015	111.925	28.119	114.713	29.254	90	
80	77.822	17.403	80.616	18.202	83.414	19.045	86.216	19.930	89.020	20.856	91.825	21.822	94.628	22.830	97.429	23.875	100.226	24.957	103.018	26.076	105.803	27.230	108.579	28.418	111.347	29.639	80	40 (H)**
70	74.513	16.968	77.314	17.846	80.118	18.770	82.923	19.740	85.726	20.753	88.526	21.808	91.321	22.903	94.109	24.042	96.889	25.216	99.659	26.428	102.417	27.673	105.163	28.957	107.891	30.278	70	35 (P)*
60	71.216	16.685	74.021	17.657	76.823	18.678	79.622	19.746	82.414	20.861	85.198	22.019	87.971	23.219	90.732	24.460	93.477	25.739	96.206	27.055							60	30 (H)**
55	67.920	16.606	70.717	17.691	73.505	18.828	76.283	20.013	79.046	21.245	81.793	22.522															55	
50	64.595	16.649	69.385	17.785	72.161	18.973	74.923	20.211	77.666	21.495																	50	30 (P)*
45	64.593	16.811	67.360	18.032	70.108	19.304																					45	30 (H)**
40																											40	25 (H)**
35																											35	28 (P)*
30																											30	25 (H)**
25																											25	20 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P – Plain & Rolling Terrain **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

$\Delta = 71°$

Deviation Angle = 71 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	1790.733	570.822	1793.235	570.825	1795.738	570.830	1798.241	570.833	1800.745	570.842	1803.249	570.850	1805.754	570.858	1808.260	570.868	1810.766	570.879	1813.273	570.891	1815.780	570.903	1818.288	570.917	1820.797	570.932	2500	
2200	1576.746	502.334	1579.248	502.328	1581.751	502.333	1584.255	502.340	1586.759	502.347	1589.264	502.356	1591.770	502.366	1594.276	502.377	1596.783	502.389	1599.291	502.403	1601.800	502.417	1604.309	502.433	1606.818	502.450	2200	
2000	1434.088	456.659	1436.590	456.664	1439.094	456.669	1441.598	456.677	1444.103	456.685	1446.608	456.695	1449.114	456.706	1451.621	456.718	1454.129	456.731	1456.637	456.746	1459.147	456.762	1461.657	456.779	1464.167	456.799	2000	
1800	1291.429	410.995	1293.932	411.000	1296.436	411.006	1298.941	411.014	1301.446	411.023	1303.952	411.034	1306.459	411.046	1308.967	411.059	1311.476	411.074	1313.985	411.091	1316.495	411.108	1319.006	411.128	1321.518	411.148	1800	
1500	1077.443	342.498	1079.946	342.504	1082.450	342.511	1084.956	342.521	1087.462	342.532	1089.970	342.545	1092.478	342.559	1094.987	342.575	1097.498	342.593	1100.009	342.613	1102.521	342.635	1105.035	342.657	1107.549	342.682	1500	
1200	863.456	274.002	865.960	274.009	868.466	274.019	870.973	274.031	873.481	274.044	875.990	274.061	878.500	274.079	881.012	274.099	883.525	274.121	886.039	274.146	888.554	274.172	891.071	274.201	893.589	274.232	1200	
1000	720.799	228.338	723.304	228.347	725.811	228.359	728.319	228.373	730.828	228.389	733.339	228.409	735.852	228.431	738.366	228.455	740.881	228.481	743.398	228.511	745.917	228.543	748.436	228.577	750.958	228.615	1000	
900	649.470	205.507	651.976	205.517	654.484	205.530	656.992	205.545	659.503	205.564	662.015	205.585	664.529	205.609	667.045	205.636	669.562	205.666	672.081	205.699	674.601	205.734	677.123	205.773	679.646	205.814	900	
800	578.142	182.676	580.648	182.687	583.157	182.701	585.667	182.719	588.179	182.740	590.693	182.764	593.208	182.791	595.726	182.821	598.245	182.855	600.766	182.892	603.289	182.932	605.813	182.975	608.340	183.021	800	
700	506.814	159.845	509.322	159.858	511.831	159.874	514.342	159.895	516.856	159.918	519.372	159.946	521.890	159.977	524.410	160.011	526.931	160.050	529.456	160.092	531.981	160.138	534.510	160.187	537.040	160.240	700	100 (P)*
600	435.486	137.015	437.995	137.030	440.506	137.050	443.020	137.073	445.535	137.100	448.054	137.133	450.575	137.169	453.098	137.209	455.623	137.254	458.151	137.303	460.681	137.356	463.214	137.414	465.749	137.476	600	
500	364.159	114.187	366.670	114.205	369.183	114.227	371.699	114.255	374.218	114.289	376.740	114.327	379.265	114.371	381.792	114.419	384.323	114.473	386.856	114.532	389.393	114.596	391.932	114.665	394.473	114.739	500	
400	292.833	91.360	295.346	91.382	297.863	91.411	300.383	91.446	302.907	91.488	305.434	91.536	307.965	91.590	310.500	91.651	313.037	91.718	315.579	91.791	318.124	91.871	320.672	91.958	323.224	92.050	400	
360	264.304	82.230	266.818	82.255	269.336	82.286	271.859	82.326	274.385	82.372	276.913	82.423	279.449	82.486	281.988	82.553	284.530	82.628	287.075	82.709	289.625	82.798	292.178	82.894	294.736	82.997	360	
300	221.510	68.536	224.027	68.566	226.549	68.605	229.076	68.652	231.607	68.707	234.143	68.771	236.684	68.844	239.229	68.925	241.779	69.014	244.334	69.112	246.893	69.219	249.457	69.333	252.025	69.457	300	80 (P)*
250	185.850	57.128	188.370	57.164	190.896	57.210	193.428	57.266	195.966	57.333	198.509	57.409	201.058	57.496	203.612	57.593	206.171	57.701	208.736	57.818	211.307	57.946	213.882	58.084	216.463	58.232	250	
230	171.586	52.569	174.108	52.604	176.637	52.634	179.171	52.715	181.712	52.788	184.259	52.871	186.812	52.966	189.370	53.071	191.935	53.188	194.505	53.316	197.081	53.455	199.663	53.605	202.250	53.766	230	
200	150.192	45.729	152.717	45.768	155.250	45.823	157.789	45.896	160.336	45.979	162.889	46.075	165.450	46.183	168.017	46.305	170.590	46.439	173.170	46.586	175.757	46.746	178.350	46.918	180.949	47.103	200	65 (P)*
170	128.799	38.883	131.328	38.936	133.867	39.004	136.413	39.086	138.968	39.184	141.530	39.297	144.100	39.425	146.678	39.568	149.264	39.725	151.857	39.898	154.458	40.086	157.066	40.289	159.681	40.506	170	
155	118.103	35.465	120.636	35.523	123.177	35.597	125.728	35.688	128.288	35.795	130.856	35.919	133.432	36.059	136.018	36.215	138.611	36.388	141.212	36.578	143.822	36.784	146.439	37.006	149.064	37.244	155	
125	96.714	28.633	99.254	28.705	101.806	28.797	104.368	28.909	106.941	29.042	109.525	29.195	112.118	29.369	114.722	29.563	117.335	29.777	119.958	30.012	122.591	30.267	125.232	30.542	127.882	30.837	125	
100	78.895	22.948	81.445	23.027	84.008	23.152	86.585	23.293	89.175	23.459	91.777	23.650	94.392	23.867	97.019	24.109	99.657	24.377	102.306	24.669	104.966	24.987	107.637	25.330	110.318	25.697	100	
90	71.799	20.677	74.324	20.777	76.895	20.905	79.479	21.061	82.078	21.245	84.691	21.458	87.317	21.698	89.955	21.967	92.607	22.264	95.270	22.589	97.944	22.941	100.630	23.321	103.326	23.728	90	50 (P)*
80	64.645	18.410	67.207	18.522	69.785	18.666	72.380	18.841	74.990	19.049	77.615	19.287	80.254	19.558	82.908	19.860	85.574	20.193	88.254	20.558	90.946	20.953	93.649	21.380	96.364	21.837	80	50 (H)**
70	57.523	16.147	60.092	16.225	62.682	16.439	65.289	16.640	67.913	16.877	70.554	17.149	73.210	17.458	75.881	17.802	78.567	18.182	81.266	18.598	83.978	19.048	86.703	19.534	89.438	20.054	70	
60	50.405	13.891	52.986	14.040	55.589	14.232	58.211	14.466	60.853	14.741	63.513	15.059	66.191	15.418	68.884	15.819	71.593	16.261	74.317	16.743	77.053	17.266	79.802	17.825	82.562	18.431	60	40 (P)*
55	46.848	12.767	49.436	12.930	52.047	13.138	54.679	13.393	57.332	13.694	60.004	14.050	62.694	14.431	65.401	14.867	68.124	15.348	70.861	15.873	73.611	16.441	76.374	17.052	79.147	17.706	55	
50	43.293	11.646	45.889	11.825	48.502	12.053	51.133	12.335	53.818	12.665	56.504	13.045	59.209	13.474	61.931	13.953	64.668	14.480	67.421	15.054	70.186	15.676	72.963	16.345	75.750	17.060	50	40 (H)**
45	39.240	10.540	42.345	10.729	44.978	10.984	47.632	11.294	50.315	11.660	53.016	12.082	55.737	12.557	58.476	13.087	61.231	13.670	63.999	14.303	66.780	14.991	69.571	15.729	72.371	16.516	45	35 (P)*
40	36.190	9.421	38.807	9.644	41.454	9.939	44.127	10.279	46.825	10.690	49.544	11.162	52.284	11.695	55.042	12.288	57.814	12.930	60.600	13.648	63.396	14.413	66.200	15.234	69.010	16.109	40	35 (H) 30 (P)*
30	32.645	8.320	35.277	8.575	37.941	8.901	40.633	9.299	43.351	9.797	46.092	10.304	48.853	10.909	51.631	11.581	54.422	12.319	57.223	13.120	60.032	13.983	62.846	14.906	65.661	15.888	35	
33	31.228	7.883	33.867	8.153	36.539	8.499	39.241	8.920	41.968	9.416	44.718	9.984	47.488	10.624	50.274	11.334	53.072	12.112	55.879	12.956	58.692	13.865	61.506	14.836	64.320	15.867	33	
30	29.106	7.233	31.757	7.530	34.442	7.909	37.158	8.372	39.901	8.914	42.666	9.536	45.450	10.236	48.247	11.011	51.055	11.858	53.868	12.777	56.683	13.763	59.495	14.814	62.300	15.928	30	30 (H)**
25	25.376	6.167	28.252	6.522	30.965	6.976	33.710	7.527	36.481	8.173	39.272	8.910	42.077	9.736	44.890	10.647	47.704	11.640	50.515	12.710	53.515	13.854	56.100	15.066	58.864	16.341	25	
23	24.169	5.750	26.856	6.136	29.583	6.628	32.341	7.224	35.124	7.922	37.925	8.717	40.736	9.607	43.550	10.586	46.361	11.649	49.162	12.793	51.945	14.010	54.704	15.296			23	25 (P)*
20	22.064	5.135	24.772	5.581	27.521	6.144	30.300	6.824	33.100	7.617	35.912	8.518	38.736	9.520	41.533	10.619	44.325	11.803	47.091	13.071							20	25 (H)**
15	18.579	4.186	21.333	4.768	24.124	5.503	26.934	6.368	29.747	7.407	32.547	8.550	35.318	9.805													15	20 (P)*
14	17.888	4.011	20.652	4.633	23.451	5.417	26.264	6.355	29.073	7.433	31.860	8.637															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 71 Degrees

$\Delta = 71°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S		
metre																											metre	
2500	1823.306	570.948	1825.816	570.965	1828.326	570.983	1830.837	571.002	1833.349	571.022	1835.861	571.043	1838.373	571.065	1840.886	571.088	1843.400	571.112	1845.915	571.137	1848.430	571.163	1850.945	571.190	1853.462	571.218	2500	
2200	1609.329	502.468	1611.860	502.487	1614.351	502.507	1616.864	502.529	1619.377	502.552	1621.891	502.575	1624.405	502.601	1626.920	502.627	1629.436	502.654	1631.952	502.682	1634.469	502.712	1636.987	502.743	1639.505	502.775	2200	
2000	1466.679	456.817	1469.191	456.839	1471.704	456.861	1474.217	456.885	1476.732	456.909	1479.247	456.936	1481.763	456.963	1484.279	456.992	1486.797	457.022	1489.314	457.053	1491.833	457.086	1494.353	457.120	1496.873	457.155	2000	
1860	1324.031	411.170	1326.544	411.194	1329.059	411.219	1331.574	411.245	1334.090	411.272	1336.606	411.302	1339.124	411.332	1341.642	411.364	1344.161	411.397	1346.681	411.432	1349.202	411.469	1351.724	411.506	1354.246	411.545	1860	
1500	1110.064	342.708	1112.580	342.737	1115.097	342.767	1117.615	342.798	1120.135	342.832	1122.654	342.866	1125.176	342.903	1127.697	342.941	1130.220	342.981	1132.744	343.023	1135.269	343.067	1137.794	343.112	1140.321	343.159	1500	
1200	896.108	274.265	898.628	274.301	901.149	274.338	903.672	274.377	906.195	274.419	908.720	274.462	911.246	274.508	913.774	274.556	916.302	274.606	918.832	274.658	921.363	274.713	923.895	274.770	926.428	274.828	1200	
1000	753.480	228.654	756.004	228.697	758.530	228.741	761.057	228.789	763.585	228.839	766.115	228.891	768.646	228.946	771.179	229.004	773.713	229.064	776.248	229.126	778.785	229.192	781.323	229.260	783.863	229.330	1000	
900	682.172	205.858	684.699	205.905	687.227	205.955	689.757	206.007	692.288	206.063	694.821	206.121	697.355	206.182	699.892	206.246	702.429	206.313	704.969	206.382	707.510	206.455	710.052	206.530	712.596	206.608	900	
800	610.868	183.071	613.398	183.124	615.930	183.180	618.463	183.239	620.999	183.301	623.536	183.367	626.075	183.436	628.615	183.507	631.157	183.582	633.701	183.661	636.247	183.742	638.794	183.827	641.344	183.915	800	
700	539.572	160.297	542.106	160.357	544.642	160.421	547.180	160.489	549.720	160.560	552.263	160.635	554.807	160.713	557.353	160.796	559.901	160.881	562.451	160.971	565.003	161.064	567.557	161.161	570.113	161.261	700	
600	468.286	137.542	470.826	137.612	473.368	137.687	475.912	137.766	478.459	137.849	481.008	137.936	483.559	138.028	486.113	138.124	488.668	138.224	491.226	138.328	493.787	138.437	496.349	138.550	498.914	138.667	600	
500	397.018	114.818	399.565	114.903	402.115	114.992	404.668	115.087	407.224	115.187	409.782	115.292	412.343	115.401	414.906	115.516	417.473	115.637	420.042	115.762	422.613	115.892	425.188	116.028	427.765	116.168	500	
400	325.779	92.149	328.337	92.255	330.899	92.366	333.465	92.485	336.033	92.609	338.605	92.740	341.181	92.878	343.759	93.022	346.341	93.172	348.926	93.328	351.514	93.491	354.106	93.660	356.700	93.836	400	
360	297.297	83.107	299.862	83.224	302.430	83.349	305.002	83.480	307.578	83.618	310.158	83.764	312.741	83.917	315.327	84.076	317.917	84.243	320.511	84.417	323.108	84.598	325.709	84.785	328.313	84.980	360	100 (P)*
350	290.178	80.850	292.745	80.970	295.315	81.098	297.889	81.233	300.467	81.376	303.048	81.525	305.634	81.682	308.223	81.846	310.815	82.018	313.411	82.197	316.011	82.383	318.614	82.576	321.221	82.776	350	
300	254.498	69.389	257.175	69.730	259.756	69.879	262.341	70.036	264.931	70.202	267.525	70.377	270.123	70.560	272.726	70.751	275.332	70.951	277.943	71.159	280.558	71.376	283.176	71.602	285.799	71.835	300	
250	219.049	58.391	221.640	58.559	224.236	58.738	226.837	58.927	229.444	59.126	232.055	59.335	234.670	59.554	237.291	59.784	239.916	60.024	242.546	60.273	245.181	60.533	247.820	60.803	250.464	61.083	250	
230	204.843	53.938	207.441	54.121	210.045	54.315	212.654	54.520	215.269	54.737	217.888	54.964	220.513	55.202	223.143	55.451	225.778	55.712	228.417	55.983	231.062	56.265	233.712	56.558	236.366	56.862	230	80 (P)*
200	183.555	47.301	186.166	47.511	188.784	47.734	191.408	47.970	194.037	48.219	196.672	48.480	199.313	48.753	201.960	49.040	204.612	49.339	207.269	49.650	209.932	49.974	212.600	50.310	215.273	50.659	200	
170	162.303	40.739	164.932	40.986	167.567	41.248	170.210	41.525	172.859	41.817	175.514	42.123	178.176	42.445	180.844	42.781	183.518	43.132	186.198	43.497	188.883	43.877	191.575	44.272	194.272	44.681	170	
155	151.606	37.499	154.336	37.770	156.983	38.057	159.637	38.361	162.298	38.680	164.965	39.016	167.640	39.368	170.321	39.736	173.008	40.120	175.702	40.520	178.401	40.936	181.107	41.368	183.818	41.816	155	65 (P)*
125	130.542	31.152	133.209	31.487	135.885	31.842	138.569	32.217	141.260	32.612	143.959	33.027	146.666	33.461	149.379	33.915	152.099	34.389	154.826	34.882	157.560	35.394	160.299	35.926	163.044	36.477	125	
100	113.008	26.690	115.708	26.907	118.417	26.948	121.135	27.415	123.861	27.905	126.595	28.420	129.337	28.959	132.086	29.522	134.842	30.109	137.604	30.719	140.372	31.353	143.146	32.010	145.926	32.690	100	
90	106.033	24.163	108.749	24.625	111.475	25.115	114.209	25.631	116.952	26.174	119.703	26.743	122.462	27.339	125.227	27.961	127.999	28.609	130.777	29.283	133.560	29.983	136.349	30.708	139.143	31.458	90	50 (P)
80	99.089	22.324	101.824	22.842	104.568	23.390	107.322	23.968	110.083	24.575	112.852	25.212	115.628	25.878	118.411	26.572	121.199	27.296	123.993	28.047	126.791	28.827	129.594	29.634	132.400	30.468	80	50 (H)**
70	92.185	20.698	94.941	21.196	97.706	21.819	100.480	22.474	103.261	23.163	106.049	23.884	108.843	24.637	111.643	25.423	114.447	26.239	117.254	27.087	120.065	27.966	122.877	28.874	125.692	29.812	70	
60	85.333	19.073	88.112	19.753	90.899	20.472	93.694	21.228	96.495	22.021	99.300	22.851	102.109	23.717	104.922	24.618	107.736	25.553	110.550	26.523	113.365	27.526	116.178	28.561	118.989	29.629	60	40 (P)*
55	81.930	18.402	84.721	19.140	87.519	19.918	90.323	20.736	93.132	21.594	95.944	22.490	98.758	23.424	101.572	24.395	104.387	25.403	107.200	26.445	110.010	27.523	112.816	28.634	115.616	29.777	55	
50	78.545	17.820	81.347	18.624	84.154	19.472	86.966	20.362	89.780	21.294	92.595	22.267	95.409	23.280	98.221	24.332	101.030	25.421	103.833	26.547	106.631	27.708	109.420	28.903	112.200	30.132	50	40 (H)**
45	75.177	17.352	77.988	18.235	80.802	19.165	83.617	20.140	86.431	21.160	89.242	22.222	92.049	23.325	94.849	24.469	97.642	25.651	100.425	26.870	103.196	28.125	105.955	29.414	108.698	30.736	45	35 (P)*
40	71.824	17.036	74.639	18.014	77.452	19.041	80.262	20.116	83.067	21.237	85.863	22.401	88.649	23.611	91.423	24.859	94.182	26.146	96.925	27.470							40	30 (H)**
35	68.474	16.925	71.282	18.017	74.082	19.161	76.872	20.354	79.649	21.593	82.409	22.878															35	
33	67.128	16.956	69.928	18.099	72.718	19.295	75.493	20.540	78.250	21.832																	33	30 (P)*
30	65.095	17.101	67.875	18.329	70.636	19.609																					30	30 (H)**
25																											25	25 (P)*
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P – Plain & Rolling Terrain **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 72 Degrees

$\Delta = 72°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	1823.856	590.174	1826.358	590.177	1828.861	590.182	1831.365	590.188	1833.869	590.195	1836.373	590.202	1838.878	590.211	1841.384	590.221	1843.890	590.232	1846.397	590.244	1848.905	590.256	1851.413	590.271	1853.922	590.285	2500	
2200	1605.894	519.354	1608.397	519.358	1610.900	519.364	1613.404	519.370	1615.908	519.378	1618.413	519.386	1620.919	519.396	1623.426	519.408	1625.933	519.420	1628.440	519.433	1630.949	519.448	1633.458	519.464	1635.968	519.481	2200	
2000	1460.586	472.141	1463.089	472.146	1465.592	472.152	1468.097	472.159	1470.602	472.167	1473.107	472.177	1475.614	472.188	1478.121	472.200	1480.628	472.213	1483.137	472.228	1485.647	472.244	1488.157	472.262	1490.667	472.281	2000	
1800	1315.278	424.928	1317.781	424.933	1320.285	424.940	1322.790	424.948	1325.295	424.957	1327.802	424.968	1330.309	424.980	1332.816	424.993	1335.325	425.009	1337.835	425.023	1340.345	425.043	1342.857	425.062	1345.369	425.083	1800	
1600	1097.317	354.110	1099.820	354.115	1102.325	354.123	1104.830	354.132	107.337	354.144	1109.844	354.156	1112.353	354.171	1114.862	354.187	1117.373	354.206	1119.885	354.225	1122.397	354.247	1124.910	354.270	1127.425	354.295	1600	
1400	879.355	283.291	881.860	283.299	884.365	283.308	886.873	283.320	889.381	283.334	891.890	283.350	894.401	283.368	896.913	283 389	899.426	283.411	901.940	283.436	904.456	283.463	906.972	283.492	909.490	283.523	1400	
1200	734.048	236.079	736.553	236.088	739.061	236.100	741.569	226.114	744.078	236.131	746.590	236.150	749.102	226.172	751.617	236.197	754.132	236.223	756.649	236.253	759.168	236.285	761.688	236.320	764.210	236.357	1200	
1000	661.395	212.474	663.901	212.484	666.408	212.497	668.917	212.513	671.428	212.531	673.941	212.552	676.455	212.577	678.971	212.604	681.488	212.634	684.007	212.667	686.528	212.703	689.050	212.741	691.574	212.783	1000	
800	588.742	188.869	591.248	188.880	593.757	188.894	596.267	188.912	598.779	188.933	601.293	188.957	603.809	188.985	606.327	189.015	608.847	189.049	611.368	189.086	613.891	189.126	616.416	189.170	618.943	189.216	800	
700	516.089	165.264	518.596	165.277	521.106	165.293	523.618	165.313	526.132	165.338	528.648	165.365	531.166	165.396	533.686	165.431	536.208	165.470	538.733	165.512	541.259	165.558	543.788	165.608	546.319	165.661	700	100 (P)*
600	443.436	141.660	445.945	141.675	448.456	141.694	450.970	141.718	453.486	141.746	456.005	141.778	458.526	141.814	461.050	141.855	463.575	141.900	466.104	141.950	468.635	142.003	471.168	142.061	473.704	142.124	600	
500	370.784	118.057	373.295	118.075	375.808	118.098	378 325	118.126	380.844	118.160	383.367	118.199	385.892	118.242	388.420	118.291	390.951	118.345	393.485	118.405	396.022	118.469	398.562	118.539	401.104	118.613	500	
480	298.134	94.456	300.647	94.479	303.164	94.508	305.684	94.543	308.208	94.585	310.736	94.633	313.267	94.688	315.803	94.749	318.341	94.816	320.883	94.891	323.429	94.971	325.978	95.058	328 531	95.151	480	
460	269.074	85.017	271.588	85.042	274.107	85.074	276.630	85.113	279.156	85.160	281.688	85.213	284.222	85.274	286.761	85.342	289.304	85.417	291.851	85.499	294.401	85.589	296.956	85.685	299 514	85.789	460	
440	261.809	82.637	264.324	82.683	266.843	82.716	269.366	82.756	271.894	82.804	274.426	82.859	276.961	82.922	279.501	82.992	282.045	83.069	284.594	83.153	287.146	83.245	289.701	83.344	292.261	83.451	440	
420	225.485	70.859	228.003	70.889	230.525	70.928	233.052	70.975	235.584	71.031	238.121	71.095	240.663	71.168	243.209	71.250	245.760	71.339	248.316	71.438	250.876	71.545	253.441	71.661	256.010	71.785	420	80 (P)*
400	189.162	59.063	191.683	59.099	194.210	59.146	196.743	59.202	199.281	59.269	201.825	59.346	204.374	59.434	206.930	59.532	209.490	59.640	212.057	59.758	214.628	59.887	217.205	60.026	219.788	60.175	400	
380	174.634	54.346	177.157	54.385	179.686	54.436	182.221	54.497	184.762	54.570	187.310	54.654	189.864	54.749	192.424	54.855	194.989	54.973	197.561	55.101	200.139	55.241	202.722	55.393	205.311	55.554	380	
360	152.842	47.271	155.368	47.317	157.901	47.374	160.442	47.445	162.989	47.529	165.544	47.625	168.105	47.733	170.673	47.857	173.249	47.992	175.830	48.140	178.419	48.301	181.013	48.474	183.615	48.660	360	
340	131.052	40.200	133.582	40.253	136.121	40.321	138.668	40.404	141.224	40.503	143.788	40.616	146.359	40.745	148.939	40.888	151.526	41.047	154.121	41.221	156.724	41.410	159.334	41.614	161.951	41.833	340	65 (P)*
320	120.157	36.665	122.691	36.723	125.233	36.798	127.783	36.889	130.346	36.997	132.915	37.122	135.491	37.263	138.080	37.420	140.675	37.595	143.279	37.785	145.890	37.992	148.510	38.216	151.137	38.456	320	
300	98.371	29.601	100.912	29.673	103.465	29.766	106.028	29.879	108.603	30.013	111.188	30.167	113.783	30.342	116.389	30.537	119.005	30.753	121.630	30.989	124.265	31.245	126.910	31.522	129.563	31.819	300	
280	80.221	23.723	82.272	23.811	85.337	23.928	87.915	24.070	90.307	24.237	93.111	24.430	95.728	24.648	98.357	24.891	100.998	25.161	103.651	25.453	106.314	25.775	108.989	26.119	111.673	26.489	280	
260	72.963	21.375	75.519	21.475	78.091	21.604	80.677	21.761	83.278	21.946	85.893	22.160	88.522	22.402	91.163	22.673	93.817	22.971	96.484	23.298	99.162	23.653	101.852	24.035	104.553	24.445	260	
240	65.706	19.030	68.269	19.143	70.849	19.287	73.446	19.464	76.058	19.673	78.686	19.913	81.328	20.185	83.985	20.489	86.655	20.825	89.339	21.191	92.035	21.589	94.743	22.018	97.462	22.478	240	50 (H)**
220	58.452	16.690	61.024	16.819	63.613	16.984	66.224	17.186	68.850	17.424	71.494	17.699	74.153	18.009	76.828	18.356	79.518	18.738	82.222	19.156	84.939	19.609	87.669	20.098	90.410	20.621	220	
200	51.202	14.357	53.785	14.507	56.389	14.700	59.014	14.935	61.659	15.212	64.323	15.532	67.004	15.894	69.702	16.297	72.416	16.741	75.144	17.227	77.887	17.753	80.642	18.319	83.408	18.926	200	40 (P)*
180	47.579	13.104	50.169	13.358	52.782	13.568	55.417	13.824	58.073	14.127	60.748	14.475	63.443	14.869	66.155	15.308	68.882	15.791	71.625	16.319	74.382	16.891	77.151	17.506	79.931	18.164	180	
160	43.938	12.033	46.536	12.215	49.129	12.446	51.825	12.727	54.494	13.060	57.184	13.442	59.893	13.874	62.620	14.356	65.364	14.886	68.122	15.464	70.894	16.090	73.678	16.763	76.473	17.482	160	40 (H)**
140	40.339	10.880	42.947	11.080	45.582	11.336	48.242	11.649	50.926	12.018	53.632	12.441	56.358	12.920	59.103	13.455	61.864	14.039	64.639	14.678	67.427	15.370	70.226	16.112	73.034	16.904	140	35 (P)*
120	36.723	9.732	39.343	9.957	41.972	10.245	44.609	10.596	47.321	11.009	50.095	11.482	52.842	12.021	55.605	12.617	58.385	13.273	61.178	13.986	63.983	14.758	66.796	15.582	69.615	16.462	120	33 (H) 30 (P)*
100	33.112	8.593	35.747	8.849	38.414	9.178	41.111	9.578	43.834	10.049	46.581	10.590	49.348	11.199	52.133	11.875	54.932	12.617	57.742	13.423	60.561	14.292	63.384	15.221	66.209	16.208	100	
90	31.669	8.141	34.311	8.412	36.987	8.761	39.693	9.185	42.426	9.683	45.182	10.255	47.959	10.899	50.752	11.613	53.559	12.396	56.375	13.246	59.197	14.160	62.022	15.138	64.847	16.175	90	
80	29.507	7.467	32.161	7.766	34.851	8.148	37.572	8.613	40.321	9.160	43.093	9.786	45.884	10.489	48.690	11.269	51.506	12.122	54.329	13.046	57.155	14.039	59.978	15.097	62.795	16.217	80	30 (H)**
70	25.913	6.564	28.492	6.721	31.310	7.178	34.041	7.732	36.939	8.382	39.638	9.124	42.455	9.955	45.274	10.872	48.100	11.871	50.923	12.948	53.754	14.099	56.553	15.318	59.370	16.602	70	25 (P)*
60	24.479	5.931	27.171	6.319	29.902	6.814	32.667	7.415	35.458	8.117	38.267	8.917	41.083	9.812	43.913	10.797	46.753	11.868	49.548	13.018	52.344	14.244	55.117	15.538			60	
50	22.335	5.298	25.048	5.742	27.803	6.309	30.589	6.993	33.398	7.791	36.219	8.698	39.044	9.707	41.864	10.812	44.668	12.006	47.448	13.281							50	25 (H)**
45	18.786	4.307	21.546	4.893	24.345	5.635	27.165	6.523	29.989	8.548	32.801	-8.699	35.586	9.961													45	20 (P)*
40	18.082	4.124	20.853	4.750	23.660	5.540	26.484	6.493	29.305	7.568	32.104	8.780															40	20 (H)**

*P= Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 14 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 72 Degrees

$\Delta = 72°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed Limit
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1886.431	590.301	1858.941	590.318	1961.451	590.336	1865.962	590.355	1866.474	590.375	1868.987	590.397	1871.499	590.419	1874.013	590.442	1876.527	590.466	1879.042	590.491	1881.557	590.518	1884.073	590.545	1886.589	590.573	2500	
2200	1658.479	519.499	1640.990	519.518	1643.502	519.539	1646.015	519.560	1648.528	519.583	1651.042	519.607	1653.557	519.633	1656.072	519.659	1658.588	519.686	1661.104	519.715	1663.622	519.745	1666.140	519.776	1668.658	519.808	2200	
2000	1493.179	472.300	1495.692	472.322	1498.205	472.344	1500.719	472.368	1503.233	472.393	1505.749	472.419	1508.265	472.447	1510.781	472.476	1513.299	472.506	1515.817	472.538	1518.336	472.571	1520.856	472.605	1523.376	472.640	2000	
1800	1347.882	425.105	1350.396	425.129	1352.910	425.154	1355.426	425.180	1357.942	425.208	1360.458	425.237	1362.976	425.268	1365.495	425.300	1368.015	425.334	1370.535	425.369	1373.056	425.406	1375.578	425.443	1378.101	425.483	1800	
1600	1129.940	354.321	1132.457	354.350	1134.975	354.380	1137.493	354.412	1140.012	354.445	1142.532	354.480	1145.054	354.517	1147.576	354.556	1150.100	354.596	1152.624	354.638	1155.149	354.682	1157.675	354.727	1160.203	354.775	1600	
1400	912.010	283.536	914.530	283.592	917.052	283.629	919.575	283.668	922.099	283.710	924.625	283.754	927.151	283.801	929.679	283.849	932.208	283.899	934.738	283.952	937.270	284.007	939.802	284.063	942.336	284.122	1400	
1200	766.733	236.397	769.258	236.440	771.784	236.483	774.311	236.532	776.840	236.583	779.370	236.635	781.902	236.691	784.436	236.749	786.970	236.809	789.506	236.872	792.044	236.938	794.583	237.006	797.123	237.077	1200	
1000	604.100	212.827	606.627	212.875	609.156	212.925	701.687	212.977	704.219	213.033	706.752	213.092	709.287	213.153	711.824	213.217	714.363	213.285	716.903	213.355	719.444	213.428	721.988	213.504	724.532	213.582	1000	
800	621.472	189.266	624.003	189.319	626.535	189.376	629.069	189.435	631.605	189.498	634.143	189.564	636.682	189.633	639.224	189.706	641.767	189.781	644.312	189.860	646.858	189.942	649.406	190.027	651.957	190.116	800	
700	548.851	165.718	551.386	165.779	553.923	165.844	556.462	165.911	559.003	165.983	561.546	166.058	564.091	166.137	566.638	166.220	569.187	166.307	571.738	166.396	574.291	166.490	576.846	166.588	579.403	166.689	700	
600	478.242	142.190	478.782	142.261	481.325	142.336	483.870	142.415	486.418	142.499	488.968	142.587	491.520	142.679	494.074	142.776	496.631	142.876	499.190	142.981	501.752	143.091	504.315	143.204	506.882	143.322	600	
500	403.650	118.693	406.198	118.778	408.749	118.868	411.303	118.963	413.859	119.063	416.419	119.169	418.981	119.280	421.546	119.396	424.113	119.517	426.684	119.642	429.257	119.774	431.833	119.910	434.411	120.051	500	
450	331.067	95.251	333.647	95.357	336.210	95.469	338.777	95.589	341.347	95.714	343.920	95.846	346.497	95.984	349.077	96.129	351.661	96.280	354.247	96.437	356.837	96.601	359.430	96.771	362.027	96.948	450	
400	302.077	85.900	304.642	86.017	307.212	86.143	309.786	86.275	312.363	86.414	314.944	86.561	317.529	86.714	320.117	86.875	322.709	87.042	325.305	87.217	327.904	87.399	330.506	87.588	333.113	87.783	400	
350	294.825	83.565	297.393	83.686	299.965	83.815	302.541	83.951	305.120	84.094	307.703	84.245	310.290	84.403	312.881	84.568	315.475	84.740	318.073	84.920	320.675	85.108	323.280	85.302	325.889	85.504	350	
300	258.584	71.918	261.163	72.060	263.745	72.210	266.333	72.368	268.924	72.535	271.520	72.711	274.120	72.895	276.725	73.088	279.333	73.289	281.946	73.499	284.563	73.717	287.184	73.943	289.810	74.179	300	
250	222.376	60.334	224.968	60.504	227.566	60.684	230.170	60.874	232.778	61.074	235.391	61.283	238.009	61.505	240.633	61.736	243.260	61.977	245.893	62.229	248.531	62.490	251.173	62.762	253.820	63.043	250	
230	207.906	55.727	210.506	55.911	213.112	56.107	215.723	56.313	218.340	56.531	220.962	56.760	223.589	57.000	226.222	57.254	228.859	57.512	231.502	57.785	234.150	58.069	236.803	58.364	239.460	58.670	230	80 (P)*
200	186.222	48.859	188.836	49.071	191.456	49.296	194.082	49.533	196.715	49.783	199.353	50.046	201.996	50.321	204.646	50.609	207.301	50.910	209.962	51.223	212.629	51.549	215.300	51.888	217.977	52.239	200	
175	164.576	42.067	167.207	42.316	169.846	42.579	172.491	42.858	175.143	43.152	177.802	43.460	180.467	43.784	183.139	44.122	185.817	44.475	188.501	44.842	191.190	45.225	193.886	45.622	196.587	46.034	175	
150	143.772	36.712	146.415	36.985	149.065	39.274	151.722	39.579	154.387	39.901	157.058	40.239	159.737	40.593	162.421	40.963	165.113	41.350	167.811	41.752	170.515	42.171	173.225	42.605	175.941	43.056	150	
125	123.226	32.136	124.899	32.473	127.577	32.830	130.264	33.208	132.960	33.605	135.664	34.023	138.375	34.460	141.093	34.916	143.819	35.393	146.551	35.889	149.290	36.405	152.035	36.940	154.786	37.494	125	
100	104.368	26.884	107.073	27.304	109.787	27.748	112.509	28.218	115.241	28.711	117.980	29.229	120.728	29.772	123.483	30.338	126.245	30.929	129.014	31.543	131.789	32.181	134.570	32.842	137.357	33.526	100	
90	107.264	24.883	109.986	25.348	112.717	25.840	115.457	26.360	118.206	26.906	120.962	27.479	123.727	28.079	126.499	28.705	129.278	29.357	132.063	30.035	134.855	30.739	137.651	31.468	140.453	32.223	90	50 (P)
80	100.193	22.969	102.933	23.490	105.684	24.042	108.443	24.623	111.211	25.234	113.987	25.875	116.770	26.545	119.560	27.244	122.357	27.972	125.158	28.728	127.965	29.512	130.777	30.325	133.592	31.164	80	50 (H)**
70	93.162	21.179	95.925	21.771	98.697	22.397	101.478	23.057	104.266	23.750	107.062	24.475	109.864	25.234	112.672	26.024	115.485	26.846	118.301	27.699	121.121	28.583	123.944	29.497	126.768	30.441	70	
60	86.185	19.571	88.972	20.256	91.767	20.979	94.570	21.740	97.379	22.538	100.194	23.373	103.012	24.244	105.834	25.151	108.658	26.093	111.484	27.068	114.309	28.078	117.133	29.120	119.956	30.194	60	40 (P)*
55	82.722	18.865	83.521	19.607	88.327	20.390	91.140	21.213	93.958	22.076	96.780	22.978	99.604	23.918	102.429	24.895	105.254	25.909	108.079	26.999	110.900	28.043	113.718	29.161	116.531	30.311	55	
50	79.276	18.247	82.087	19.056	84.904	19.910	87.723	20.806	90.549	21.744	93.374	22.723	96.199	23.742	99.023	24.800	101.843	25.896	104.659	27.029	107.469	28.197	110.271	29.400	113.064	30.637	50	40 (H)**
45	75.850	17.745	78.670	18.634	81.494	19.569	84.319	20.551	87.144	21.576	89.967	22.645	92.786	23.758	95.599	24.906	98.404	26.096	101.200	27.323	103.985	28.586	106.757	29.883	109.515	31.213	45	35 (P)*
40	72.439	17.295	73.264	18.179	78.089	19.413	80.911	20.492	83.727	21.623	86.536	22.796	89.335	24.011	92.122	25.268	94.895	26.563	97.652	27.895							40	30 (H)**
36	69.034	17.253	71.854	18.351	74.667	19.502	77.469	20.702	80.259	21.950	83.033	23.242															36	
33	67.667	17.271	70.480	18.421	73.282	19.625	76.070	20.878	78.841	22.178																	33	30 (P)*
30	65.603	17.397	68.396	18.633	71.172	19.922																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

P – Plain & Rolling Terrain **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 73 Degrees

$\Delta = 73°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1857.405	610.010	1859.907	610.014	1862.410	610.019	1864.913	610.024	1867.417	610.031	1869.922	610.039	1872.427	610.048	1874.933	610.058	1877.439	610.069	1879.946	610.081	1882.454	610.093	1884.962	610.108	1887.471	610.123	2500	
2200	1635.417	536.810	1637.919	536.814	1640.422	536.820	1642.926	536.826	1645.431	536.834	1647.936	536.843	1650.442	536.853	1652.949	536.864	1655.456	536.876	1657.964	536.890	1660.473	536.905	1662.982	536.921	1665.492	536.938	2200	
2000	1487.425	488.010	1489.927	488.015	1492.431	488.021	1494.935	488.028	1497.440	488.037	1499.946	488.046	1502.453	488.057	1504.960	488.069	1507.468	488.083	1509.977	488.098	1512.486	488.114	1514.997	488.132	1517.508	488.150	2000	
1800	1339.433	439.211	1341.936	439.216	1344.440	439.222	1346.945	439.230	1349.450	439.240	1351.957	439.250	1354.464	439.262	1356.972	439.276	1359.481	439.291	1361.991	439.308	1364.501	439.326	1367.013	439.345	1369.525	439.366	1800	
1500	1117.446	366.011	1119.949	366.018	1122.454	366.025	1124.959	366.034	1127.466	366.046	1129.974	366.059	1132.482	366.073	1134.992	366.090	1137.503	366.108	1140.015	366.128	1142.528	366.150	1145.041	366.173	1147.556	366.198	1500	
1200	893.459	292.813	895.963	292.820	900.469	292.830	902.976	292.842	905.484	292.856	907.994	292.872	910.505	292.890	913.017	292.911	915.530	292.933	918.045	292.958	920.561	292.985	923.078	293.014	925.596	293.046	1200	
1000	747.468	244.014	749.973	244.023	752.480	244.035	754.989	244.049	757.498	244.066	760.010	244.085	762.523	244.107	765.037	244.132	767.553	244.159	770.071	244.189	772.590	244.221	775.110	244.256	777.633	244.294	1000	
900	673.472	219.615	675.978	219.625	678.486	219.638	680.995	219.654	683.506	219.673	686.019	219.694	688.533	219.719	691.050	219.746	693.568	219.776	696.087	219.810	698.608	219.845	701.131	219.884	703.655	219.926	900	
800	599.477	195.217	601.984	195.228	604.493	195.242	607.003	195.260	609.515	195.281	612.030	195.305	614.546	195.333	617.064	195.364	619.584	195.398	622.106	195.435	624.630	195.476	627.155	195.519	629.683	195.566	800	
700	523.482	170.818	527.990	170.831	530.500	170.848	533.012	170.868	535.526	170.892	538.042	170.920	540.561	170.952	543.082	170.987	545.604	171.025	548.129	171.068	550.656	171.115	553.186	171.165	555.717	171.218	700	100 (P)*
600	451.488	146.421	453.997	146.436	456.508	146.456	459.022	146.479	461.539	146.507	464.058	146.540	466.580	146.576	469.104	146.617	471.630	146.663	474.159	146.712	476.690	146.766	479.224	146.825	481.760	146.887	600	
500	377.494	122.025	380.005	122.043	382.519	122.066	385.035	122.094	387.555	122.128	390.078	122.167	392.604	122.211	395.132	122.260	397.664	122.315	400.199	122.375	402.736	122.439	405.277	122.509	407.820	122.584	500	
400	303.502	97.630	306.015	97.653	308.532	97.682	311.053	97.718	313.578	97.760	316.106	97.808	318.638	97.863	321.174	97.925	323.713	97.993	326.256	98.067	328.803	98.148	331.353	98.236	333.907	98.330	400	
360	273.303	87.873	276.420	87.898	278.939	87.931	281.462	87.970	284.065	88.017	289.056	88.071	289.056	88.132	291.596	88.201	294.140	88.276	296.687	88.359	299.239	88.449	301.794	88.546	304.354	88.651	360	
320	266.506	85.434	269.021	85.460	271.541	85.493	274.065	85.534	276.593	85.582	279.125	85.638	281.661	85.701	284.202	85.771	286.747	85.849	289.296	85.934	291.849	86.026	294.406	86.126	296.967	86.234	320	
300	229.311	73.240	232.029	73.270	234.552	73.309	237.079	73.356	239.612	73.412	242.150	73.477	244.692	73.551	247.239	73.633	249.791	73.723	252.348	73.823	254.910	73.930	257.476	74.047	260.046	74.172	300	80 (P)*
250	192.518	61.047	195.039	61.083	197.566	61.130	200.099	61.187	202.638	61.255	205.183	61.332	207.734	61.420	210.290	61.519	212.852	61.627	215.420	61.747	217.993	61.876	220.571	62.016	223.155	62.166	250	
230	177.727	56.171	180.244	56.211	182.774	56.261	185.309	56.323	187.852	56.396	190.400	56.481	192.955	56.577	195.516	56.684	198.083	56.802	200.656	56.931	203.235	57.072	205.820	57.224	208.411	57.387	230	
200	155.526	48.859	158.053	48.904	160.587	48.962	163.128	49.034	165.676	49.118	168.232	49.215	170.795	49.325	173.364	49.448	175.941	49.584	178.524	49.733	181.114	49.894	183.711	50.069	186.314	50.256	200	
180	133.334	41.549	135.865	41.602	138.404	41.671	140.953	41.755	143.509	41.854	146.074	41.968	148.647	42.097	151.228	42.242	153.817	42.402	156.414	42.577	159.019	42.767	161.631	42.972	164.251	43.192	180	65 (P)*
155	122.238	37.896	124.772	37.954	127.315	38.029	129.868	38.121	132.430	38.230	135.001	38.355	137.581	38.497	140.169	38.656	142.766	38.831	145.372	39.023	147.985	39.231	150.607	39.456	153.237	39.697	155	
125	100.050	30.594	102.592	30.666	105.145	30.759	107.710	30.873	110.286	31.008	112.872	31.163	115.470	31.339	118.078	31.535	120.696	31.753	123.324	31.990	125.962	32.248	128.609	32.526	131.266	32.825	125	
100	81.384	24.517	84.116	24.607	86.682	24.724	89.262	24.866	91.855	25.033	94.462	25.228	97.081	25.448	99.713	25.693	102.357	25.964	105.013	26.260	107.680	26.582	110.358	26.929	113.047	27.301	100	
90	74.172	22.090	76.729	22.190	79.302	22.320	81.891	22.478	84.494	22.665	87.111	22.880	89.742	23.124	92.386	23.396	95.044	23.697	97.714	24.025	100.396	24.382	103.090	24.767	105.796	25.180	90	50 (P)*
80	66.781	19.666	69.346	19.779	71.927	19.923	74.526	20.103	77.140	20.313	79.771	20.555	82.416	20.829	85.076	21.134	87.750	21.472	90.437	21.841	93.138	22.242	95.850	22.673	98.575	23.136	80	50 (H)**
70	59.393	17.247	61.966	17.376	64.559	17.542	67.170	17.745	69.799	17.985	72.446	18.261	75.109	18.574	77.787	18.923	80.481	19.308	83.190	19.728	85.912	20.185	88.647	20.676	91.394	21.203	70	
60	52.609	14.834	54.594	14.985	57.200	15.179	59.828	15.416	62.476	15.695	65.143	16.017	67.828	16.381	70.530	16.787	73.249	17.234	75.983	17.723	78.731	18.252	81.492	18.822	84.265	19.432	60	
55	48.319	13.632	50.911	13.797	53.526	14.008	56.164	14.266	58.823	14.570	61.503	14.921	64.201	15.317	66.918	15.759	69.651	16.246	72.400	16.777	75.162	17.353	77.938	17.972	80.726	18.634	55	
50	44.031	12.433	47.231	12.614	49.837	12.847	52.506	13.130	55.179	13.464	57.873	13.849	60.587	14.284	63.319	14.769	66.068	15.302	68.833	15.885	71.612	16.515	74.403	17.192	77.206	17.916	50	40 (H)**
45	40.941	11.239	43.552	11.402	46.193	11.598	48.857	12.013	51.545	12.384	54.256	12.810	56.987	13.292	59.737	13.828	62.505	14.418	65.287	15.062	68.083	15.757	70.890	16.504	73.709	17.301	45	35 (P)*
40	37.263	10.051	39.885	10.277	42.538	10.567	45.219	10.921	47.925	11.327	50.655	11.812	53.407	12.355	56.177	12.955	58.963	13.614	61.764	14.332	64.577	15.108	67.399	15.939	70.228	16.825	40	35 (H) 30 (P)*
35	33.582	8.873	36.223	9.131	38.894	9.461	41.595	9.864	44.323	10.338	47.076	10.882	49.850	11.495	52.642	12.176	55.449	12.922	58.268	13.734	61.096	14.608	63.929	15.543	66.765	16.537	35	
33	32.116	8.405	34.761	8.678	37.440	9.029	40.151	9.455	42.889	9.957	45.652	10.533	48.435	11.180	51.236	11.899	54.051	12.687	56.877	13.543	59.709	14.463	62.545	15.447	65.381	16.491	33	
30	29.914	7.708	32.571	8.008	35.265	8.393	37.991	8.861	40.746	9.411	43.525	10.041	46.323	10.749	49.138	11.534	51.964	12.393	54.797	13.323	57.633	14.321	60.468	15.386	63.297	16.514	30	30 (H)**
25	26.251	6.585	28.926	6.925	31.660	7.384	34.417	7.942	37.202	8.596	40.009	9.343	42.831	10.179	45.664	11.102	48.500	12.108	51.334	13.192	54.159	14.350	56.970	15.577	59.761	16.869	25	
23	24.793	6.117	27.489	6.507	30.226	7.006	32.997	7.610	35.795	8.316	38.613	9.122	41.444	10.023	44.280	11.014	47.114	12.092	49.939	13.250	52.748	14.483	55.536	15.785			23	25 (P)*
20	22.609	5.460	25.328	5.908	28.088	6.477	30.882	7.166	33.700	7.969	36.531	8.882	39.367	9.897	42.198	11.009	45.015	12.211	47.809	13.493							20	25 (H)**
15	18.996	4.431	21.762	5.021	24.569	5.767	27.398	6.661	30.224	7.693	33.059	8.851	35.857	10.121													15	20 (P)*
14	18.279	4.261	21.057	4.870	23.872	5.665	26.706	6.615	29.539	7.707	32.351	8.926															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 9 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 73 Degrees

$\Delta = 73°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1889.980	610.139	1892.490	610.156	1895.001	610.174	1897.513	610.193	1900.024	610.213	1902.537	610.235	1905.050	610.257	1907.564	610.280	1910.078	610.304	1912.593	610.330	1915.109	610.356	1917.625	610.384	1920.142	610.412	2500	
2200	1668.003	536.956	1670.514	536.975	1673.026	536.996	1675.539	537.018	1678.053	537.041	1680.567	537.065	1683.082	537.090	1685.598	537.117	1688.114	537.144	1690.631	537.173	1693.148	537.203	1695.667	537.235	1698.186	537.267	2200	
2000	1520.000	488.170	1522.512	488.192	1525.046	488.215	1527.560	488.239	1530.074	488.264	1532.590	488.291	1535.107	488.318	1537.624	488.347	1540.142	488.378	1542.660	488.409	1545.180	488.443	1547.700	488.477	1550.221	488.512	2000	
1800	1372.038	439.389	1374.552	439.412	1377.067	439.438	1379.583	439.464	1382.099	439.492	1384.617	439.521	1387.135	439.552	1389.654	439.585	1392.174	439.619	1394.694	439.654	1397.216	439.691	1399.738	439.729	1402.261	439.769	1800	
1500	1150.072	366.225	1152.588	366.253	1155.106	366.283	1157.625	366.315	1160.145	366.349	1162.666	366.384	1165.188	366.422	1167.710	366.461	1170.234	366.501	1172.759	366.543	1175.284	366.588	1177.811	366.633	1180.339	366.681	1500	
1200	928.116	293.079	930.637	293.115	933.159	293.153	935.682	293.192	938.207	293.235	940.733	293.279	943.260	293.325	945.788	293.374	948.318	293.425	950.849	293.478	953.381	293.533	955.914	293.590	958.448	293.649	1200	
1000	780.156	244.354	782.681	244.377	785.208	244.422	787.735	244.470	790.265	244.521	792.796	244.574	795.328	244.629	797.862	244.688	800.397	244.749	802.934	244.812	805.473	244.878	808.012	244.947	810.553	245.018	1000	
900	706.181	219.971	708.709	220.018	711.239	220.069	713.769	220.122	716.302	220.178	718.836	220.237	721.372	220.299	723.910	220.364	726.449	220.431	728.990	220.502	731.532	220.575	734.076	220.651	736.622	220.731	900	
800	632.212	195.616	634.743	195.670	637.276	195.727	639.811	195.787	642.347	195.850	644.886	195.916	647.426	195.986	649.968	196.059	652.512	196.135	655.058	196.214	657.605	196.296	660.155	196.382	662.706	196.471	800	
700	558.250	171.275	560.785	171.336	563.323	171.401	565.863	171.470	568.404	171.542	570.948	171.618	573.494	171.697	576.042	171.781	578.592	171.868	581.144	171.958	583.698	172.053	586.254	172.151	588.812	172.252	700	
600	484.299	146.954	486.841	147.026	489.384	147.101	491.930	147.181	494.479	147.265	497.029	147.354	499.583	147.447	502.138	147.544	504.696	147.645	507.256	147.751	509.819	147.861	512.384	147.975	514.951	148.094	600	
500	410.366	122.663	412.916	122.750	415.468	122.841	418.023	122.937	420.580	123.037	423.141	123.144	425.704	123.255	428.270	123.372	430.839	123.493	433.411	123.620	435.985	123.752	438.562	123.889	441.142	124.031	500	
450	386.464	98.430	389.025	98.537	391.589	98.650	394.157	98.770	396.729	98.896	399.303	99.029	401.882	99.168	404.463	99.313	407.048	99.465	409.637	99.624	412.229	99.789	414.824	99.960	417.422	100.138	450	
400	362.517	84.762	365.084	88.880	367.656	89.007	370.232	89.139	372.809	89.280	375.390	89.427	377.974	89.582	380.562	89.743	383.153	89.912	385.748	90.088	388.346	90.271	390.947	90.462	393.552	90.659	400	100 (P)*
350	339.532	86.348	342.102	86.470	344.675	86.600	347.252	86.737	349.833	86.881	352.419	87.032	355.009	87.191	357.598	87.358	360.193	87.531	362.795	87.712	365.401	87.901	368.011	88.096	370.627	88.300	350	
300	262.622	74.306	265.202	74.448	267.786	74.599	270.375	74.759	272.969	74.927	275.566	75.104	278.169	75.289	280.775	75.483	283.386	75.685	286.001	75.896	288.621	76.116	291.244	76.344	293.872	76.581	300	
250	225.745	62.326	228.339	62.497	230.939	62.678	233.545	62.869	236.155	63.071	238.771	63.283	241.391	63.505	244.017	63.737	246.647	63.980	249.283	64.233	251.923	64.496	254.568	64.770	257.218	65.053	250	
230	211.008	57.561	213.610	57.747	216.218	57.944	218.831	58.151	221.451	58.370	224.075	58.601	226.705	58.842	229.340	59.094	231.981	59.358	234.626	59.633	237.277	59.918	239.933	60.215	242.594	60.523	230	80 (P)*
200	188.524	50.457	191.040	50.670	194.163	50.896	196.791	51.135	199.426	51.386	202.067	51.651	204.714	51.928	207.367	52.218	210.025	52.520	212.690	52.836	215.359	53.164	218.035	53.505	220.716	53.858	200	
180	166.878	43.428	169.512	43.678	172.154	43.944	174.802	44.224	177.458	44.520	180.120	44.831	182.788	45.156	185.463	45.496	188.145	45.852	190.833	46.222	193.527	46.606	196.227	47.006	198.933	47.420	180	
155	152.875	39.955	155.521	40.230	161.174	40.521	163.835	40.828	166.503	41.152	169.178	41.492	171.860	41.849	174.549	42.221	177.245	42.610	179.947	43.015	182.655	43.437	185.370	43.874	188.091	44.327	156	65 (P)*
125	123.932	33.144	126.607	33.484	139.290	33.844	141.982	34.223	144.682	34.623	147.390	35.043	150.106	35.483	152.829	35.943	155.560	36.423	158.298	36.922	161.042	37.441	163.793	37.979	166.550	38.537	125	
100	115.746	27.699	118.455	28.121	121.173	28.568	123.901	29.041	126.638	29.538	129.383	30.059	132.137	30.605	134.898	31.175	137.666	31.769	140.442	32.387	143.224	33.028	146.012	33.695	148.807	34.384	100	
90	108.312	23.620	111.238	26.088	113.974	26.584	116.720	27.107	119.475	27.656	122.238	28.233	125.009	28.837	127.788	29.467	130.574	30.123	133.367	30.806	136.165	31.514	138.970	32.248	141.780	33.008	90	50 (P)
80	101.310	23.630	104.057	24.154	106.813	24.709	109.579	25.295	112.353	25.910	115.136	26.555	117.927	27.229	120.725	27.933	123.529	28.665	126.339	29.426	129.154	30.215	131.974	31.033	134.798	31.878	80	50 (H)**
70	84.152	21.764	86.921	23.300	89.700	22.960	92.488	23.654	95.284	24.351	98.088	25.082	100.898	25.845	103.715	26.640	106.536	27.468	109.362	28.326	112.192	29.216	115.025	30.136	117.859	31.086	70	
60	67.049	20.082	69.843	20.771	92.647	21.499	95.458	22.265	98.275	23.068	101.099	23.908	103.927	24.785	106.759	25.698	109.593	26.645	112.429	27.627	115.265	28.643	118.101	29.692	120.935	30.773	60	40 (P)*
55	83.524	19.339	86.331	20.086	89.146	20.874	91.968	21.703	94.795	22.571	97.626	23.479	100.460	24.425	103.296	25.408	106.133	26.429	108.968	27.485	111.801	28.576	114.631	29.701	117.457	30.859	55	
50	80.017	15.683	82.837	15.900	85.661	20.358	88.494	21.260	91.328	22.204	94.164	23.190	97.000	24.215	99.835	25.280	102.667	26.383	105.495	27.523	108.318	28.699	111.133	29.910	113.940	31.154	50	40 (H)**
45	76.531	18.147	79.361	19.042	82.193	19.984	85.031	20.972	87.767	22.004	90.701	23.079	93.432	24.197	96.358	25.355	99.176	26.552	101.985	27.787	104.784	29.058	107.576	30.364	110.343	31.702	45	35 (P)*
40	73.062	12.763	75.896	18.754	78.734	19.794	81.567	20.883	84.396	22.019	87.218	23.199	90.030	24.422	92.831	25.687	95.618	26.990	98.389	28.331							40	30 (H)**
35	69.601	17.588	72.433	18.694	75.258	19.852	78.074	21.060	80.878	22.316	83.666	23.616															35	
33	68.213	17.593	71.038	18.731	73.854	19.962	76.685	21.224	79.440	22.532																	33	30 (P)*
30	66.117	17.702	68.924	18.946	71.714	20.243																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 74 Degrees

$\Delta = 74°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	189.346	630.343	189.389	630.346	189.392	630.351	189.895	630.357	190.399	630.364	190.904	630.372	190.409	630.380	190.913	630.390	191.422	630.401	191.929	630.413	191.437	630.426	191.945	630.441	192.454	630.456	2500	
2300	166.321	554.703	166.723	554.707	167.023	554.712	167.231	554.719	167.335	554.727	167.341	554.736	168.047	554.746	168.254	554.757	168.561	554.770	168.769	554.783	169.378	554.798	169.587	554.814	169.598	554.831	2300	
2000	151.411	504.276	151.711	504.281	151.961	504.287	152.212	504.294	152.426	504.303	152.532	504.312	152.639	504.323	152.146	504.336	153.464	504.349	153.763	504.365	153.673	504.381	154.184	504.399	154.695	504.417	2000	
1800	136.500	453.850	136.603	453.855	136.907	453.862	137.012	453.869	137.918	453.879	137.932	453.890	137.932	453.902	138.440	453.916	138.949	453.931	138.459	453.948	138.970	453.966	139.481	453.986	139.994	454.006	1800	
1600	113.783	378.211	114.033	378.217	114.284	378.225	114.536	378.234	114.856	378.245	115.052	378.259	115.282	378.273	115.582	378.290	115.893	378.308	116.045	378.328	116.552	378.350	116.574	378.374	116.797	378.399	1600	
1400	91.170	302.570	91.374	302.580	91.579	302.590	91.728	302.602	92.015	302.615	92.304	302.632	92.496	302.650	92.329	302.671	93.043	302.694	93.343	302.719	93.644	302.746	93.946	302.775	94.249	302.807	1400	
1200	76.106	252.147	76.256	252.156	76.607	252.168	76.858	252.182	77.109	252.199	77.360	252.219	77.611	252.241	77.863	252.266	78.163	252.293	78.417	252.323	78.671	252.356	78.926	252.391	79.229	252.429	1200	
1000	68.206	226.935	68.312	226.945	68.418	226.958	69.229	226.974	69.540	226.993	69.852	227.014	70.076	227.039	70.388	227.067	70.583	227.097	70.823	227.131	71.084	227.167	71.367	227.206	71.892	227.248	1000	
900	61.052	201.723	61.158	201.734	61.367	201.749	61.878	201.767	62.089	201.788	62.301	201.812	62.422	201.840	62.940	201.871	63.460	201.906	63.983	201.943	63.507	201.984	63.033	202.028	64.561	202.073	900	
800	53.998	176.511	54.103	176.525	54.305	176.541	54.528	176.562	54.842	176.586	54.599	176.614	55.078	176.646	55.599	176.681	55.122	176.720	55.647	176.763	56.175	176.810	56.704	176.860	56.236	176.914	800	100 (P)*
700	45.944	151.301	46.153	151.316	46.665	151.336	47.179	151.359	47.693	151.387	47.215	151.420	47.737	151.457	47.261	151.499	48.318	151.549	48.375	151.604	48.933	151.669	49.492	151.707	49.922	151.770	700	
600	38.429	126.091	38.602	126.110	38.932	126.133	39.316	126.161	39.533	126.195	39.753	126.235	39.402	126.279	40.931	126.328	40.464	126.383	40.999	126.443	40.939	126.509	41.207	126.579	41.462	126.655	600	
500	30.893	100.884	31.033	100.904	31.173	100.936	31.316	100.971	31.460	101.014	31.605	101.063	32.454	101.118	32.606	101.180	32.959	101.249	33.115	101.324	33.272	101.405	33.431	101.493	33.592	101.587	500	
450	27.799	90.802	27.930	90.822	28.062	90.859	28.333	90.899	28.385	90.946	28.437	91.000	29.293	91.062	29.349	91.131	29.706	91.207	29.865	91.280	30.026	91.381	30.188	91.479	30.926	91.584	450	
400	24.704	80.722	24.826	80.737	24.949	80.755	25.179	80.779	25.230	80.808	25.281	80.842	25.136	80.882	26.088	80.928	26.440	80.979	26.594	81.037	26.749	81.100	26.906	81.170	27.063	81.245	400	
350	21.608	70.632	21.720	70.645	21.833	70.662	22.033	70.684	22.076	70.710	22.120	70.742	21.980	70.779	22.824	70.822	23.135	70.871	23.270	70.926	23.406	70.987	23.543	71.054	23.680	71.128	350	80 (P)*
300	18.511	60.541	18.614	60.553	18.718	60.568	18.890	60.589	18.923	60.612	18.960	60.642	18.824	60.677	19.568	60.719	19.832	60.767	19.947	60.821	20.063	60.881	20.180	60.948	20.297	61.021	300	
250	15.415	50.450	15.508	50.461	15.602	50.475	15.747	50.495	15.771	50.519	15.800	50.550	15.686	50.587	16.309	50.633	16.527	50.685	16.623	50.744	16.719	50.809	16.816	50.880	16.913	50.958	250	
230	14.189	46.416	14.274	46.426	14.360	46.439	14.491	46.458	14.517	46.480	14.545	46.508	14.435	46.542	15.004	46.583	15.214	46.631	15.302	46.685	15.390	46.746	15.479	46.814	15.567	46.888	230	
200	12.341	40.365	12.416	40.374	12.491	40.386	12.605	40.403	12.628	40.424	12.653	40.451	12.564	40.484	13.057	40.525	13.236	40.572	13.315	40.626	13.394	40.687	13.473	40.755	13.552	40.830	200	
180	11.107	36.329	11.174	36.337	11.241	36.348	11.342	36.363	11.362	36.382	11.385	36.407	11.308	36.438	11.751	36.477	11.913	36.523	11.984	36.577	12.055	36.638	12.126	36.707	12.197	36.783	180	
160	9.873	32.292	9.933	32.300	9.993	32.310	10.083	32.323	10.101	32.340	10.122	32.362	10.053	32.389	10.445	32.423	10.589	32.465	10.653	32.513	10.716	32.568	10.780	32.629	10.844	32.696	160	
140	8.639	28.254	8.691	28.262	8.743	28.271	8.820	28.283	8.839	28.298	8.857	28.317	8.794	28.340	9.139	28.369	9.265	28.406	9.321	28.450	9.376	28.500	9.432	28.557	9.488	28.622	140	
120	7.404	24.217	7.449	24.224	7.494	24.232	7.558	24.242	7.575	24.255	7.592	24.272	7.535	24.292	7.833	24.317	7.941	24.348	7.990	24.386	8.037	24.429	8.084	24.477	8.132	24.533	120	
100	6.170	20.181	6.208	20.187	6.245	20.193	6.297	20.202	6.312	20.213	6.326	20.226	6.277	20.243	6.528	20.264	6.618	20.290	6.659	20.322	6.698	20.358	6.737	20.398	6.776	20.444	100	
90	5.553	18.163	5.587	18.168	5.620	18.174	5.667	18.182	5.681	18.192	5.693	18.203	5.649	18.219	5.875	18.238	5.956	18.261	5.993	18.290	6.028	18.322	6.063	18.358	6.098	18.400	90	
80	4.936	16.145	4.967	16.150	4.996	16.155	5.038	16.162	5.050	16.171	5.060	16.181	5.021	16.194	5.222	16.212	5.294	16.232	5.327	16.258	5.358	16.287	5.389	16.321	5.420	16.356	80	
70	4.319	14.126	4.346	14.131	4.371	14.135	4.408	14.142	4.418	14.150	4.427	14.158	4.392	14.170	4.569	14.185	4.632	14.203	4.660	14.226	4.688	14.251	4.715	14.281	4.742	14.311	70	
60	3.702	12.108	3.725	12.112	3.747	12.116	3.778	12.121	3.787	12.128	3.795	12.136	3.764	12.146	3.916	12.158	3.970	12.174	3.994	12.193	4.018	12.215	4.041	12.241	4.065	12.267	60	
50	3.085	10.090	3.104	10.093	3.122	10.097	3.149	10.101	3.156	10.107	3.162	10.113	3.137	10.121	3.264	10.132	3.309	10.145	3.328	10.161	3.348	10.179	3.367	10.201	3.387	10.223	50	
45	2.776	9.081	2.793	9.083	2.810	9.086	2.834	9.091	2.840	9.096	2.846	9.102	2.823	9.109	2.938	9.119	2.978	9.130	2.995	9.145	3.013	9.161	3.030	9.181	3.048	9.201	45	
40	2.468	8.072	2.483	8.074	2.498	8.076	2.520	8.080	2.525	8.085	2.530	8.090	2.510	8.097	2.612	8.106	2.648	8.116	2.663	8.129	2.679	8.143	2.694	8.161	2.710	8.179	40	
35	2.160	7.063	2.173	7.065	2.186	7.067	2.205	7.070	2.209	7.074	2.214	7.079	2.196	7.085	2.286	7.093	2.317	7.101	2.330	7.113	2.344	7.126	2.357	7.141	2.371	7.157	35	
33	2.037	6.659	2.049	6.661	2.062	6.663	2.080	6.666	2.084	6.670	2.088	6.675	2.071	6.681	2.156	6.688	2.185	6.697	2.198	6.708	2.211	6.720	2.223	6.735	2.236	6.751	33	
30	1.851	6.054	1.862	6.056	1.873	6.058	1.890	6.060	1.894	6.063	1.898	6.068	1.882	6.073	1.960	6.080	1.986	6.088	1.998	6.098	2.010	6.109	2.021	6.122	2.033	6.137	30	
25	1.542	5.045	1.551	5.046	1.561	5.048	1.575	5.050	1.578	5.053	1.582	5.057	1.568	5.061	1.633	5.067	1.655	5.074	1.665	5.082	1.675	5.091	1.684	5.102	1.694	5.114	25	
23	1.419	4.641	1.427	4.642	1.436	4.644	1.449	4.646	1.452	4.649	1.455	4.653	1.443	4.657	1.502	4.663	1.523	4.670	1.532	4.679	1.541	4.687	1.550	4.697	1.559	4.708	23	
20	1.234	4.036	1.241	4.037	1.248	4.038	1.260	4.040	1.263	4.042	1.265	4.045	1.255	4.049	1.306	4.055	1.324	4.062	1.332	4.070	1.340	4.077	1.348	4.086	1.356	4.095	20	
15	0.925	3.027	0.931	3.028	0.936	3.029	0.945	3.030	0.947	3.032	0.949	3.034	0.941	3.037	0.980	3.041	0.993	3.047	0.999	3.053	1.005	3.059	1.011	3.066	1.017	3.073	15	
14	0.864	2.826	0.869	2.827	0.874	2.828	0.882	2.829	0.884	2.831	0.886	2.833	0.878	2.835	0.915	2.838	0.927	2.844	0.933	2.851	0.938	2.856	0.944	2.863	0.950	2.869	14	

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 74 Degrees

$\Delta = 74°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
3500	1923.964	630.472	1926.474	630.489	1928.985	630.507	1931.497	630.527	1934.009	630.547	1936.521	630.568	1939.035	630.591	1941.549	630.614	1944.063	630.639	1946.579	630.664	1949.095	630.691	1951.611	630.719	1954.128	630.747	3500	
2700	1697.908	554.849	1700.420	554.869	1702.933	554.890	1705.446	554.912	1707.960	554.935	1710.474	554.959	1712.989	554.985	1715.505	555.011	1718.022	555.039	1720.539	555.068	1723.057	555.098	1725.576	555.130	1728.095	555.162	2700	
2400	1547.207	504.438	1549.720	504.459	1552.233	504.482	1554.748	504.505	1557.263	504.531	1559.779	504.558	1562.296	504.586	1564.813	504.615	1567.331	504.646	1569.850	504.678	1572.370	504.711	1574.891	504.746	1577.412	504.782	2400	
2100	1396.507	454.028	1398.022	454.053	1401.537	454.078	1404.053	454.105	1406.570	454.133	1409.087	454.163	1411.606	454.194	1414.125	454.227	1416.645	454.261	1419.166	454.296	1421.688	454.333	1424.211	454.372	1426.735	454.411	2100	
1800	1170.463	378.426	1172.980	378.454	1175.499	378.485	1178.018	378.517	1180.538	378.551	1183.059	378.586	1185.581	378.624	1188.104	378.663	1190.628	378.704	1193.154	378.746	1195.680	378.791	1198.207	378.837	1200.735	378.885	1800	
1200	944.430	302.841	946.952	302.877	949.474	302.915	951.998	302.955	954.523	302.997	957.049	303.042	959.577	303.088	962.106	303.137	964.636	303.188	967.167	303.242	969.700	303.297	972.234	303.355	974.769	303.414	1200	
1000	793.732	252.469	796.278	252.512	798.805	252.558	801.333	252.606	803.863	252.657	806.395	252.710	808.928	252.767	811.462	252.825	813.999	252.886	816.536	252.950	819.075	253.017	821.615	253.086	824.157	253.157	1000	
900	718.419	227.393	720.947	227.341	723.477	227.391	726.009	227.445	728.542	227.501	731.077	227.561	733.613	227.623	736.152	227.688	738.692	227.756	741.233	227.827	743.776	227.901	746.321	227.978	748.868	228.058	900	
800	643.091	202.123	645.622	202.179	648.156	202.237	650.691	202.297	653.229	202.360	655.768	202.427	658.309	202.497	660.852	202.571	663.396	202.647	665.943	202.727	668.491	202.810	671.042	202.896	673.594	202.985	800	
700	567.770	176.972	570.306	177.033	572.845	177.098	575.385	177.167	577.927	177.240	580.472	177.316	583.019	177.396	585.568	177.480	588.119	177.568	590.671	177.659	593.227	177.754	595.784	177.853	598.343	177.955	700	
600	492.461	151.838	495.003	151.909	497.547	151.986	500.094	152.066	502.644	152.151	505.195	152.240	507.750	152.333	510.306	152.431	512.865	152.533	515.427	152.639	517.991	152.750	520.557	152.863	523.125	152.985	600	
500	417.170	126.735	419.720	126.821	422.273	126.913	424.829	127.009	427.388	127.111	429.949	127.218	432.514	127.330	433.082	127.447	437.652	127.570	440.225	127.697	442.801	127.830	445.379	127.968	447.961	128.111	500	
400	341.910	101.689	344.472	101.756	347.038	101.910	349.607	102.031	352.180	102.158	354.756	102.291	357.336	102.431	359.919	102.578	362.506	102.731	365.096	102.890	367.690	103.056	370.287	103.229	372.887	103.408	400	
360	311.821	91.696	314.389	91.815	316.962	91.942	319.538	92.076	322.118	92.217	324.703	92.365	327.291	92.521	329.883	92.684	332.479	92.854	335.078	93.031	337.681	93.215	340.288	93.406	342.898	93.605	360	100 (P)*
350	304.300	89.201	306.871	89.324	309.445	89.454	312.024	89.592	314.606	89.737	317.193	89.890	319.783	90.049	322.377	90.217	324.975	90.392	327.577	90.574	330.183	90.763	332.793	90.960	335.406	91.165	350	
300	266.712	76.733	269.293	76.896	271.879	77.048	274.470	77.209	277.065	77.378	279.665	77.556	282.269	77.742	284.878	77.938	287.491	78.141	290.108	78.354	292.730	78.575	295.356	78.804	297.987	79.043	300	
250	229.157	64.368	231.754	64.540	234.356	64.722	236.963	64.915	239.576	65.118	242.194	65.331	244.817	65.555	247.445	65.789	250.078	66.033	252.716	66.287	255.360	66.552	258.008	66.827	260.661	67.113	250	
230	214.150	59.441	216.754	59.628	219.364	59.826	221.980	60.035	224.601	60.256	227.229	60.487	229.861	60.730	232.499	60.984	233.142	61.250	237.791	61.526	240.445	61.814	243.104	62.113	245.769	62.423	230	80 (P)*
200	191.681	52.094	194.279	52.309	196.904	52.536	199.536	52.777	202.173	53.030	204.817	53.296	207.467	53.573	210.123	53.867	212.785	54.171	215.452	54.489	218.126	54.819	220.805	55.162	223.489	55.518	200	
170	169.210	44.823	171.847	45.073	174.491	45.343	177.143	45.625	179.802	45.922	182.467	46.235	185.139	46.563	187.818	46.905	190.504	47.263	193.196	47.635	195.894	48.023	198.598	48.425	201.309	48.842	170	
150	158.006	41.230	160.654	41.306	163.311	41.799	165.975	42.109	168.646	42.434	171.325	42.777	174.011	43.135	176.704	43.511	179.404	43.902	182.110	44.310	184.824	44.734	187.543	45.174	190.269	45.630	150	65 (P)*
125	135.660	34.178	138.338	34.320	141.026	34.482	143.722	35.264	146.426	33.667	149.139	36.090	151.860	36.532	154.588	36.995	157.324	37.478	160.067	37.981	162.817	38.503	165.574	39.045	168.337	39.607	125	
100	117.147	28.534	119.835	28.959	122.578	29.409	125.311	29.884	128.053	30.384	130.804	30.909	133.564	31.459	136.331	32.032	139.106	32.630	141.888	33.253	144.678	33.899	147.473	34.569	150.275	35.262	100	
90	109.775	26.376	112.506	26.847	115.248	27.346	118.000	27.872	120.760	28.426	123.530	29.006	126.308	29.614	129.093	30.248	131.887	30.908	134.687	31.595	137.493	32.308	140.306	33.047	143.124	33.812	90	50 (P)
80	102.443	24.308	105.193	24.833	107.957	25.394	110.729	25.983	113.511	26.602	116.301	27.251	119.099	27.930	121.904	28.638	124.716	29.375	127.535	30.141	130.359	30.936	133.188	31.759	136.021	32.609	80	30 (H)**
70	95.135	22.364	97.930	22.964	100.716	23.598	103.511	24.266	106.315	24.968	109.127	25.703	111.945	26.472	114.771	27.272	117.601	28.105	120.437	28.969	123.276	29.863	126.118	30.791	128.963	31.747	70	
60	87.924	20.606	90.726	21.299	93.537	22.032	96.356	22.802	99.183	23.611	102.016	24.457	104.853	25.339	107.695	26.258	110.540	27.212	113.386	28.200	116.234	29.222	119.081	30.278	121.927	31.366	60	40 (P)*
55	84.336	19.825	87.151	20.577	89.975	21.370	92.806	22.204	95.642	23.078	98.484	23.992	101.328	24.944	104.175	25.934	107.022	26.961	109.869	28.024	112.714	29.122	115.557	30.255	118.395	31.420	55	
50	80.768	19.134	83.596	19.954	86.431	20.818	89.272	21.726	92.117	22.676	94.963	23.668	97.811	24.701	100.657	25.773	103.502	26.883	106.342	28.030	109.178	29.214	112.006	30.432	114.827	31.685	50	40 (H)**
45	77.221	18.560	80.061	19.461	82.905	20.409	85.752	21.403	88.599	22.442	91.445	23.525	94.288	24.649	97.126	25.815	99.958	27.020	102.781	28.263	105.593	29.543	108.394	30.857	111.181	32.204	45	35 (P)*
40	73.693	18.141	76.540	19.138	79.387	20.185	82.233	21.281	85.074	22.424	87.908	23.612	90.734	24.844	93.549	26.116	96.350	27.428	99.136	28.777							40	30 (H)**
35	70.176	17.932	73.020	19.045	75.858	20.211	78.687	21.427	81.504	22.690	84.306	24.000															35	
33	68.766	17.924	71.604	19.090	74.432	20.309	77.248	21.578	80.047	22.895																	33	30 (P)*
30	66.638	18.014	69.459	19.266	72.263	20.571																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Δ = 75°

Deviation Angle = 75 Degrees

R	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_C	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1923.819	651.185	1928.321	651.189	1930.824	651.194	1933.328	651.199	1935.832	651.207	1938.337	651.214	1940.842	651.223	1943.348	651.233	1945.855	651.244	1948.362	651.256	1950.870	651.269	1953.379	651.284	1955.888	651.299	2500	
2200	1695.621	573.044	1698.124	573.049	1700.627	573.054	1703.131	573.061	1705.636	573.068	1708.141	573.077	1710.648	573.087	1713.155	573.099	1715.662	573.111	1718.170	573.125	1720.679	573.140	1723.189	573.156	1725.700	573.173	2200	
2000	1542.156	520.950	1544.659	520.955	1547.163	520.961	1549.667	520.968	1552.173	520.977	1554.679	520.987	1557.185	520.998	1559.693	521.010	1562.201	521.024	1564.710	521.039	1567.220	521.056	1569.731	521.073	1572.242	521.092	2000	
1800	1388.592	468.857	1391.195	468.862	1393.699	468.868	1396.204	468.876	1398.709	468.886	1401.216	468.897	1403.724	468.909	1406.232	468.923	1408.741	468.938	1411.251	468.955	1413.762	468.974	1416.274	468.993	1418.787	469.014	1800	
1500	1156.495	390.717	1160.998	390.723	1163.503	390.730	1166.009	390.740	1168.516	390.754	1171.024	390.764	1173.532	390.779	1176.043	390.796	1178.554	390.814	1181.066	390.835	1183.579	390.856	1186.094	390.880	1188.609	390.905	1500	
1200	926.398	312.577	930.902	312.586	933.408	312.594	935.816	312.606	938.324	312.620	940.834	312.637	943.345	312.655	945.858	312.676	948.372	312.699	950.887	312.724	953.404	312.752	955.921	312.781	958.440	312.813	1200	
1000	774.833	260.464	777.339	260.493	779.846	260.505	782.355	260.520	784.865	260.537	787.377	260.556	789.891	260.579	792.406	260.604	794.922	260.631	797.440	260.661	799.960	260.694	802.482	260.729	805.005	260.768	1000	
900	698.102	234.438	700.609	234.448	703.116	234.462	705.626	234.478	708.137	234.497	710.650	234.518	713.165	234.543	715.682	234.571	718.201	234.602	720.720	234.635	723.242	234.672	725.766	234.711	728.292	234.753	900	
800	621.370	208.393	623.877	208.404	626.386	208.419	628.897	208.437	631.410	208.458	633.925	208.483	636.442	208.511	638.960	208.542	641.481	208.576	644.004	208.614	646.528	208.655	649.055	208.699	651.583	208.747	800	100 (P)*
700	544.639	182.361	547.147	182.377	549.657	182.393	552.169	182.398	554.684	182.423	557.201	182.451	559.720	182.483	562.242	182.518	564.765	182.557	567.291	182.601	569.819	182.647	572.349	182.698	574.882	182.752	700	
600	467.908	156.301	470.417	156.318	472.929	156.338	475.444	156.362	477.961	156.390	480.480	156.423	483.003	156.461	485.528	156.502	488.055	156.548	490.585	156.598	493.118	156.653	495.653	156.712	498.191	156.776	600	
500	391.178	130.260	393.689	130.278	396.203	130.302	398.720	130.331	401.241	130.365	403.765	130.404	406.291	130.449	408.821	130.499	411.354	130.554	413.890	130.614	416.429	130.680	418.971	130.751	421.516	130.827	500	
450	314.448	104.219	316.962	104.241	319.480	104.271	322.002	104.307	324.527	104.350	327.057	104.399	329.590	104.455	332.127	104.517	334.668	104.586	337.213	104.662	339.761	104.743	342.313	104.832	344.869	104.927	450	
400	283.758	93.803	286.271	93.829	288.792	93.861	291.317	93.901	293.845	93.949	296.378	94.003	298.915	94.065	301.456	94.135	304.001	94.211	306.550	94.295	309.104	94.386	311.662	94.485	314.223	94.590	400	
350	276.085	91.149	278.601	91.225	281.121	91.259	283.646	91.300	286.175	91.349	288.708	91.405	291.246	91.469	293.789	91.541	296.335	91.619	298.886	91.705	301.441	91.799	304.000	91.900	306.563	92.009	350	80 (P)*
300	237.722	78.181	240.240	78.212	242.764	78.251	245.293	78.299	247.827	78.356	250.365	78.422	252.910	78.496	255.459	78.579	258.012	78.671	260.572	78.772	263.135	78.881	265.704	78.999	268.278	79.126	300	
250	199.360	65.165	201.882	65.202	204.411	65.249	206.945	65.307	209.485	65.373	212.032	65.451	214.584	65.543	217.143	65.643	219.707	65.753	222.277	65.874	224.853	66.005	227.435	66.147	230.022	66.299	250	
230	184.016	59.960	186.540	60.000	189.071	60.051	191.608	60.114	194.152	60.188	196.702	60.274	199.259	60.371	201.823	60.479	204.392	60.599	206.968	60.730	209.550	60.873	212.139	61.027	214.733	61.192	230	
200	161.001	52.154	163.528	52.199	166.064	52.259	168.606	52.331	171.157	52.416	173.714	52.514	176.279	52.626	178.852	52.751	181.431	52.888	184.018	53.039	186.611	53.203	189.212	53.380	191.819	53.570	200	65 (P)*
170	137.987	44.350	140.520	44.404	143.061	44.473	145.611	44.558	148.170	44.659	150.737	44.774	153.313	44.906	155.897	45.052	158.490	45.214	161.091	45.391	163.700	45.584	166.316	45.792	168.941	46.015	170	
155	126.481	40.449	129.017	40.509	131.562	40.585	134.117	40.678	136.681	40.788	139.254	40.915	141.837	41.059	144.429	41.220	147.030	41.397	149.640	41.591	152.258	41.803	154.885	42.030	157.520	42.275	155	
125	101.472	32.434	106.016	32.727	108.571	32.822	111.139	32.937	113.717	33.071	116.308	33.231	118.909	33.409	121.521	33.608	124.144	33.828	126.777	34.068	129.421	34.330	132.074	34.612	134.738	34.915	125	
100	84.303	26.165	86.857	26.253	89.426	26.375	92.009	26.520	94.606	26.690	97.217	26.886	99.841	27.109	102.478	27.357	105.128	27.632	107.790	27.932	110.464	28.258	113.150	28.609	115.847	28.987	100	50 (P)*
90	76.638	23.574	79.197	23.676	81.773	23.807	84.365	23.967	86.972	24.156	89.594	24.375	92.230	24.622	94.881	24.897	97.545	25.202	100.222	25.535	102.913	25.897	105.615	26.287	108.329	26.705	90	
80	68.974	20.985	71.541	21.100	74.126	21.248	76.728	21.428	79.347	21.641	81.983	21.886	84.634	22.163	87.301	22.473	89.982	22.815	92.678	23.189	95.387	23.595	98.109	24.033	100.844	24.502	80	50 (H)**
70	61.113	18.402	63.889	18.533	66.485	18.701	69.100	18.907	71.735	19.150	74.387	19.430	77.057	19.747	79.744	20.100	82.446	20.490	85.164	20.916	87.896	21.379	90.641	21.877	93.400	22.410	70	
60	53.656	15.825	56.243	15.978	58.854	16.175	61.487	16.414	64.141	16.697	66.815	17.023	69.508	17.392	72.220	17.803	74.948	18.256	77.693	18.752	80.452	19.288	83.226	19.866	86.012	20.484	60	40 (P)*
55	49.829	14.541	52.424	14.707	55.044	14.922	57.688	15.183	60.354	15.492	63.041	15.847	65.748	16.248	68.474	16.696	71.218	17.189	73.978	17.727	76.754	18.311	79.543	18.938	82.345	19.609	55	
50	46.004	13.260	48.608	13.443	51.239	13.679	53.895	13.966	56.575	14.305	59.277	14.695	62.001	15.135	64.744	15.626	67.505	16.167	70.283	16.757	73.075	17.395	75.881	18.081	78.700	18.815	50	40 (H)**
45	42.182	11.984	44.797	12.187	47.440	12.449	50.111	12.767	52.808	13.143	55.528	13.576	58.269	14.064	61.031	14.607	63.812	15.205	66.608	15.857	69.419	16.567	72.245	17.338	75.077	18.126	45	35 (P)*
40	38.364	10.714	40.991	10.943	43.650	11.237	46.339	11.595	49.054	12.016	51.795	12.501	54.558	13.048	57.342	13.656	60.143	14.324	62.960	15.052	65.789	15.837	68.630	16.679	71.478	17.577	40	35 (H) 30 (P)*
35	34.550	9.454	37.194	9.713	39.872	10.050	42.582	10.458	45.321	10.938	48.085	11.490	50.873	12.111	53.680	12.800	56.503	13.557	59.340	14.379	62.187	15.265	65.041	16.212	67.899	17.219	35	
33	33.026	8.853	35.678	9.230	38.365	9.585	41.085	10.017	43.834	10.526	46.609	11.109	49.407	11.765	52.224	12.494	55.056	13.292	57.901	14.159	60.753	15.092	63.611	16.088	66.469	17.146	33	
30	30.743	8.207	33.407	8.512	36.110	8.902	38.846	9.376	41.613	9.933	44.405	10.571	47.220	11.289	50.051	12.084	52.896	12.954	55.750	13.896	58.608	14.908	61.466	15.987	64.320	17.130	30	30 (H)**
25	26.948	6.983	29.639	7.347	32.372	7.813	35.141	8.378	37.941	9.041	40.764	9.797	43.605	10.645	46.458	11.580	49.316	12.599	52.174	13.697	55.024	14.871	57.863	16.114	60.682	17.423	25	
23	25.434	6.501	28.138	6.898	30.886	7.403	33.671	8.015	36.484	8.731	39.320	9.547	42.170	10.460	45.028	11.463	47.886	12.556	50.736	13.729	53.573	14.979	56.389	16.299			23	25 (P)*
20	23.169	5.797	25.898	6.251	28.671	6.828	31.480	7.526	34.315	8.340	37.166	9.264	40.025	10.293	42.880	11.420	45.724	12.638	48.546	13.939							20	25 (H)**
15	19.423	4.688	22.203	5.286	25.026	6.042	27.875	6.948	30.733	7.994	33.583	9.167	36.409	10.454													15	20 (P)*
14	18.680	4.482	21.472	5.120	24.305	5.926	27.160	6.888	30.016	7.994	32.855	9.230															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 75 Degrees

TABLE 10. TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=75°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	1958.398	651.315	1960.908	651.333	1963.419	651.351	1965.931	651.370	1968.443	651.391	1970.957	651.412	1973.470	651.435	1975.984	651.459	1978.499	651.483	1981.015	651.509	1983.531	651.536	1986.048	651.563	1988.565	651.593	2500	
2200	1728.231	573.192	1730.723	573.211	1733.235	573.232	1735.749	573.254	1738.263	573.278	1740.777	573.303	1743.293	573.328	1745.809	573.355	1748.326	573.383	1750.844	573.412	1753.362	573.442	1755.881	573.474	1758.401	573.507	2200	
2000	1574.755	521.113	1577.268	521.135	1579.782	521.157	1582.296	521.182	1584.812	521.207	1587.328	521.234	1589.845	521.262	1592.363	521.292	1594.882	521.323	1597.401	521.355	1599.921	521.388	1602.442	521.423	1604.963	521.459	2000	
1800	1421.301	469.037	1423.815	469.061	1426.331	469.086	1428.847	469.113	1431.364	469.142	1433.882	469.172	1436.401	469.203	1438.921	469.236	1441.441	469.270	1443.963	469.306	1446.485	469.343	1449.008	469.382	1451.532	469.422	1800	
1500	1191.125	390.932	1193.643	390.961	1196.161	390.992	1198.681	391.024	1201.201	391.059	1203.722	391.094	1206.245	391.132	1208.769	391.172	1211.293	391.212	1213.819	391.256	1216.346	391.300	1218.874	391.346	1221.402	391.395	1500	
1200	960.961	312.847	963.483	312.883	966.005	312.921	968.530	312.962	971.058	313.004	973.582	313.049	976.110	313.096	978.640	313.146	981.171	313.197	983.702	313.250	986.236	313.306	988.770	313.365	991.306	313.424	1200	
1000	807.529	260.808	810.055	260.852	812.583	260.898	815.111	260.946	817.642	260.996	820.174	261.051	822.708	261.108	825.243	261.167	827.780	261.229	830.318	261.293	832.858	261.360	835.399	261.429	837.941	261.501	1000	
900	730.819	234.799	733.347	234.847	735.878	234.898	738.410	234.952	740.944	235.009	743.479	235.068	746.017	235.131	748.556	235.197	751.096	235.265	753.639	235.337	756.183	235.411	758.728	235.488	761.276	235.569	900	
800	654.114	208.798	656.646	208.852	659.180	208.910	661.716	208.970	664.254	209.034	666.794	209.102	669.336	209.172	671.880	209.246	674.425	209.323	676.973	209.404	679.522	209.487	682.073	209.574	684.626	209.664	800	
700	577.416	182.811	579.951	182.873	582.492	182.938	585.033	183.008	587.577	183.081	590.122	183.157	592.670	183.238	595.219	183.323	597.771	183.411	600.325	183.502	602.882	183.598	605.440	183.698	608.000	183.801	700	
600	500.731	156.844	503.274	156.916	505.819	156.992	508.367	157.073	510.917	157.159	513.470	157.248	516.025	157.342	518.583	157.441	521.143	157.543	523.706	157.651	526.271	157.762	528.838	157.878	531.408	157.998	600	
500	424.064	130.908	426.615	130.995	429.169	131.087	431.726	131.184	434.286	131.286	436.849	131.394	439.414	131.506	441.983	131.625	444.555	131.748	447.129	131.876	449.707	132.010	452.287	132.149	454.870	132.293	500	
400	347.428	105.029	349.992	105.137	352.559	105.252	355.129	105.373	357.703	105.501	360.281	105.635	362.862	105.777	365.448	105.924	368.036	106.078	370.628	106.239	373.223	106.406	375.822	106.579	378.424	106.760	400	
360	316.789	94.703	319.359	94.823	321.933	94.951	324.511	95.086	327.093	95.228	329.679	95.377	332.269	95.534	334.862	95.698	337.460	95.869	340.061	96.047	342.666	96.233	345.275	96.426	347.888	96.625	360	100 (P)*
350	309.131	92.125	311.703	92.249	314.279	92.380	316.859	92.519	319.443	92.665	322.031	92.818	324.624	92.979	327.219	93.148	329.819	93.324	332.424	93.507	335.031	93.698	337.643	93.896	340.259	94.102	350	
300	270.856	79.261	273.439	79.406	276.027	79.559	278.619	79.720	281.216	79.891	283.818	80.070	286.424	80.257	289.035	80.454	291.650	80.659	294.270	80.873	296.895	81.095	299.523	81.326	302.156	81.566	300	
250	232.615	66.461	235.214	66.634	237.816	66.818	240.427	67.011	243.042	67.216	245.662	67.431	248.288	67.656	250.919	67.891	253.554	68.137	256.195	68.393	258.842	68.660	261.493	68.937	264.149	69.224	250	
230	217.333	61.368	219.940	61.556	222.552	61.756	225.170	61.966	227.794	62.188	230.424	62.421	233.059	62.666	235.700	62.922	238.346	63.189	240.998	63.467	243.655	63.757	246.317	64.057	248.985	64.369	230	80 (P)*
200	194.434	53.773	197.035	53.989	199.682	54.218	202.316	54.460	204.956	54.715	207.603	54.982	210.256	55.263	212.915	55.557	215.580	55.864	218.252	56.183	220.929	56.516	223.611	56.861	226.300	57.219	200	
170	171.573	46.254	174.213	46.507	176.860	46.776	179.515	47.061	182.177	47.360	184.845	47.675	187.521	48.005	190.204	48.349	192.893	48.709	195.589	49.084	198.292	49.474	201.001	49.879	203.716	50.299	170	
155	160.164	42.537	162.816	42.815	165.475	43.110	168.143	43.421	170.818	43.749	173.500	44.093	176.190	44.455	178.887	44.832	181.592	45.226	184.303	45.637	187.021	46.064	189.745	46.507	192.476	46.966	155	65 (P)*
125	137.411	35.236	140.093	35.582	142.784	35.947	145.485	36.331	148.194	36.737	150.911	37.162	153.636	37.608	156.370	38.074	159.111	38.560	161.860	39.066	164.615	39.592	167.378	40.137	170.148	40.702	125	
100	118.555	29.389	121.273	29.817	124.002	30.271	126.740	30.749	129.488	31.253	132.244	31.782	135.010	32.334	137.783	32.912	140.565	33.514	143.354	34.140	146.150	34.790	148.953	35.465	151.763	36.163	100	
90	111.055	27.151	113.792	27.675	116.539	28.127	119.296	28.657	122.063	29.214	124.839	29.799	127.623	30.410	130.416	31.048	133.216	31.714	136.024	32.405	138.838	33.123	141.659	33.867	144.486	34.636	90	50 (P)
80	103.590	25.002	106.348	25.533	109.116	26.096	111.895	26.689	114.683	27.312	117.480	27.965	120.286	28.649	123.099	29.361	125.919	30.104	128.746	30.875	131.579	31.675	134.417	32.503	137.260	33.359	80	50 (H)**
70	96.171	22.970	98.951	23.585	101.746	24.221	104.548	24.894	107.360	25.601	110.179	26.341	113.007	27.114	115.840	27.920	118.680	28.758	121.525	29.628	124.374	30.529	127.227	31.462	130.082	32.424	70	
60	88.811	21.140	91.620	21.940	94.439	22.578	97.267	23.354	100.103	24.168	102.948	25.019	105.792	25.908	108.644	26.832	111.499	27.792	114.357	28.787	117.215	29.817	120.074	30.879	122.932	31.974	60	40 (P)*
55	85.159	20.323	87.982	21.080	90.815	21.878	93.655	22.718	96.501	23.598	99.353	24.518	102.208	25.476	105.065	26.473	107.924	27.507	110.782	28.577	113.640	29.682	116.495	30.822	119.346	31.996	55	
50	81.528	19.595	84.366	20.420	87.210	21.290	90.061	22.204	92.916	23.160	95.774	24.159	98.632	25.198	101.491	26.277	104.347	27.395	107.201	28.550	110.049	29.741	112.891	30.968	115.725	32.229	50	40 (H)**
45	77.920	18.983	80.770	19.890	83.624	20.844	86.482	21.845	89.341	22.891	92.199	23.981	95.054	25.113	97.905	26.287	100.750	27.500	103.586	28.751	106.413	30.039	109.228	31.362	112.030	32.718	45	35 (P)*
40	74.333	18.528	77.191	19.532	80.049	20.586	82.907	21.689	85.760	22.840	88.608	24.036	91.447	25.275	94.276	26.556	97.092	27.877	99.893	29.235							40	30 (H)**
35	70.758	18.284	73.614	19.405	76.465	20.578	79.307	21.802	82.138	23.075	84.955	24.392															35	
33	69.326	18.263	72.177	19.437	75.019	20.664	77.848	21.942	80.662	23.267																	33	30 (P)*
30	67.167	18.333	70.001	19.594	72.819	20.908																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P - Plain & Rolling Terrian **H - Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 76 Degrees

$\Delta = 76°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	1960.715	672.550	1963.218	672.554	1965.720	672.559	1968.224	672.564	1970.728	672.572	1973.233	672.579	1975.739	672.588	1978.245	672.598	1980.752	672.610	1983.259	672.622	1985.767	672.635	1988.276	672.649	1990.785	672.664	2500	
2250	1726.330	591.845	1728.833	591.850	1731.336	591.855	1733.840	591.862	1736.345	591.869	1738.851	591.878	1741.357	591.889	1743.864	591.900	1746.371	591.913	1748.880	591.927	1751.389	591.942	1753.899	591.958	1756.410	591.975	2250	
2000	1570.073	538.042	1572.576	538.047	1575.080	538.053	1577.584	538.060	1580.090	538.069	1582.596	538.077	1585.103	538.090	1587.611	538.102	1590.119	538.116	1592.628	538.131	1595.138	538.148	1597.649	538.166	1600.161	538.185	2000	
1800	1413.817	484.239	1416.320	484.244	1418.824	484.251	1421.329	484.259	1423.835	484.269	1426.342	484.280	1428.850	484.292	1431.358	484.306	1433.867	484.322	1436.378	484.338	1438.889	484.357	1441.401	484.377	1443.914	484.398	1800	
1500	1179.432	403.535	1181.936	403.542	1184.441	403.549	1186.947	403.559	1189.454	403.570	1191.962	403.584	1194.471	403.599	1196.981	403.615	1199.493	403.634	1202.005	403.654	1204.519	403.676	1207.033	403.700	1209.549	403.726	1500	
1200	945.048	322.832	947.553	322.839	950.059	322.849	952.566	322.862	955.075	322.876	957.585	322.892	960.097	322.911	962.610	322.932	965.124	322.955	967.639	322.980	970.156	323.008	972.674	323.038	975.193	323.070	1200	
1000	788.792	269.030	791.298	269.039	793.803	269.051	796.314	269.066	798.824	269.083	801.337	269.103	803.850	269.125	806.366	269.150	808.883	269.178	811.401	269.208	813.921	269.241	816.443	269.277	818.966	269.316	1000	
900	710.665	242.130	713.171	242.140	715.679	242.153	718.189	242.169	720.700	242.188	723.214	242.210	725.729	242.235	728.246	242.263	730.765	242.294	733.285	242.328	735.808	242.365	738.332	242.404	740.858	242.447	900	
800	632.537	215.229	635.044	215.241	637.553	215.256	640.064	215.274	642.577	215.295	645.093	215.320	647.610	215.348	650.129	215.380	652.650	215.414	655.173	215.452	657.698	215.494	660.225	215.538	662.754	215.586	800	100 (P)*
700	554.410	188.330	556.918	188.343	559.428	188.360	561.941	188.381	564.456	188.403	566.973	188.434	569.493	188.466	572.015	188.501	574.539	188.541	577.065	188.585	579.594	188.632	582.125	188.683	584.657	188.738	700	
600	476.283	161.431	478.793	161.446	481.305	161.466	483.820	161.490	486.337	161.519	488.857	161.552	491.380	161.589	493.905	161.631	496.433	161.677	498.964	161.728	501.497	161.783	504.033	161.843	506.571	161.908	600	
500	398.157	134.535	400.668	134.552	403.183	134.575	405.700	134.604	408.221	134.639	410.746	134.678	413.273	134.723	415.803	134.773	418.337	134.829	420.873	134.890	423.413	134.956	425.956	135.027	428.502	135.104	500	
480	320.032	107.637	322.546	107.660	325.064	107.690	327.586	107.726	330.113	107.769	332.643	107.819	335.176	107.875	337.714	107.938	340.256	108.007	342.801	108.083	345.351	108.166	347.904	108.255	350.461	108.351	480	
360	288.783	96.880	291.299	96.906	293.819	96.938	296.343	96.979	298.872	97.027	301.405	97.081	303.943	97.144	306.483	97.214	309.031	97.291	311.581	97.375	314.136	97.467	316.695	97.566	319.257	97.673	360	
350	260.971	94.190	263.487	94.217	266.007	94.251	268.532	94.292	271.062	94.341	273.596	94.398	276.135	94.462	278.678	94.534	281.225	94.613	283.777	94.700	286.333	94.795	288.894	94.896	291.458	95.006	350	
300	241.910	80.745	244.429	80.776	246.953	80.816	249.482	80.864	252.016	80.921	254.556	80.987	257.101	81.062	259.651	81.146	262.206	81.238	264.766	81.340	267.331	81.450	269.901	81.569	272.476	81.696	300	80 (P)*
250	202.850	67.302	205.373	67.339	207.902	67.387	210.437	67.445	212.978	67.514	215.525	67.593	218.079	67.683	220.638	67.783	223.204	67.894	225.775	68.016	228.353	68.148	230.936	68.290	233.525	68.443	250	
230	187.227	61.926	189.752	61.966	192.283	62.018	194.821	62.081	197.366	62.156	199.917	62.242	202.475	62.340	205.039	62.449	207.610	62.569	210.188	62.701	212.771	62.845	215.361	63.000	217.958	63.166	230	
200	163.793	53.863	166.321	53.909	168.857	53.969	171.401	54.042	173.952	54.127	176.511	54.227	179.077	54.339	181.651	54.464	184.232	54.603	186.820	54.755	189.415	54.920	192.018	55.098	194.628	55.289	200	65 (P)*
180	140.361	45.803	142.894	45.857	145.436	45.927	147.987	46.013	150.547	46.114	153.115	46.230	155.693	46.363	158.279	46.510	160.873	46.673	163.476	46.852	166.087	47.046	168.706	47.255	171.333	47.480	180	
155	128.646	41.775	131.182	41.854	133.728	41.941	136.283	42.005	138.849	42.116	141.424	42.243	144.008	42.388	146.602	42.550	149.205	42.729	151.817	42.924	154.438	43.137	157.067	43.366	159.705	43.613	155	
125	105.218	33.722	107.763	33.796	110.319	33.892	112.888	34.008	115.468	34.145	118.060	34.303	120.663	34.483	123.277	34.683	125.903	34.905	128.539	35.147	131.185	35.410	133.842	35.694	136.509	35.999	125	
100	85.700	27.021	88.235	27.113	90.825	27.232	93.410	27.377	96.009	27.549	98.622	27.747	101.249	27.971	103.889	28.221	106.541	28.497	109.207	28.799	111.885	29.127	114.574	29.481	117.275	29.861	100	
90	77.895	24.544	80.456	24.647	83.034	24.579	85.627	24.740	88.236	24.930	90.860	25.150	91.500	25.399	96.153	25.676	98.821	25.983	101.502	26.318	104.196	26.682	106.903	27.075	109.622	27.496	90	50 (P)*
80	70.692	21.670	72.660	21.786	75.247	21.934	77.851	22.116	80.473	22.330	83.111	22.577	85.765	22.856	88.435	23.168	91.121	23.512	93.820	23.889	96.534	24.298	99.261	24.738	102.001	25.210	80	50 (H)**
70	62.292	19.001	64.869	19.133	67.467	19.303	70.085	19.510	72.722	19.755	75.378	20.036	78.051	20.355	80.741	20.711	83.448	21.104	86.170	21.533	88.908	21.998	91.659	22.500	94.423	23.037	70	
60	54.495	16.339	57.083	16.493	59.698	16.691	62.333	16.932	64.990	17.217	67.668	17.546	70.365	17.917	73.081	18.331	75.815	18.787	78.565	19.285	81.330	19.826	84.110	20.407	86.904	21.030	60	40 (P)*
55	50.599	15.012	53.196	15.180	55.816	15.396	58.465	15.659	61.134	15.969	63.825	16.327	66.537	16.731	69.268	17.182	72.018	17.678	74.784	18.220	77.566	18.808	80.362	19.439	83.172	20.115	55	
50	46.705	13.689	49.211	13.873	51.944	14.110	54.603	14.400	57.287	14.741	59.994	15.133	62.72	15.577	65.471	16.071	68.238	16.616	71.022	17.209	73.822	17.852	76.635	18.543	79.462	19.281	50	40 (H)**
45	42.812	12.370	45.430	12.525	48.077	12.838	50.751	13.139	53.451	13.537	56.176	13.973	58.924	14.464	61.692	15.011	64.476	15.613	67.282	16.269	70.101	16.979	72.933	17.741	75.776	18.554	45	35 (P)*
40	38.926	11.058	41.555	11.288	44.218	11.584	46.910	11.944	49.630	12.369	52.376	12.857	55.146	13.408	57.936	14.020	60.744	14.693	63.569	15.423	66.408	16.216	69.257	17.064	72.116	17.967	40	35 (H) 30 (P)*
35	35.042	9.755	37.689	10.018	40.371	10.336	43.085	10.766	45.829	11.250	48.600	11.805	51.394	12.430	54.209	13.124	57.041	13.886	59.887	14.714	62.744	15.605	65.608	16.559	68.477	17.573	35	
33	33.491	9.237	36.145	9.516	38.836	9.874	41.561	10.309	44.316	10.821	47.098	11.408	49.903	12.069	52.728	12.802	55.569	13.606	58.423	14.479	61.286	15.418	64.154	16.421	67.025	17.486	33	
30	31.167	8.666	33.834	8.733	36.541	9.165	39.282	9.643	42.055	10.204	44.855	10.846	47.677	11.569	50.517	12.369	53.372	13.245	56.236	14.194	59.105	15.213	61.975	16.299	64.842	17.449	30	30 (H)**
25	27.302	7.200	29.997	7.567	32.735	8.036	35.511	8.605	38.318	9.271	41.149	10.035	44.000	10.887	46.865	11.826	49.733	12.854	52.602	13.960	55.466	15.141	58.318	16.393	61.152	17.711	25	
23	25.760	6.703	28.469	7.101	31.223	7.609	34.014	8.225	36.836	8.946	39.680	9.768	42.541	10.687	45.409	11.698	48.279	12.797	51.143	13.978	53.994	15.236	56.824	16.565			23	25 (P)*
20	23.455	5.971	26.188	6.428	28.968	7.010	31.785	7.713	34.629	8.532	37.490	9.463	40.360	10.498	43.228	11.633	46.085	12.859	48.922	14.169							20	23 (H)**
15	19.641	4.821	22.427	5.423	25.259	6.185	28.118	7.097	30.988	8.149	33.851	9.330	36.691	10.626													15	20 (P)*
14	18.885	4.607	21.684	5.250	24.526	6.061	27.391	7.029	30.260	8.143	33.113	9.387															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 76 Degrees

$\Delta = 76°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c	T_s	E_c		
metre																											metre	
2500	1993.295	672.481	1995.806	672.698	1998.317	672.917	2000.829	672.736	2003.342	672.757	2005.855	672.779	2008.369	672.801	2010.884	672.825	2013.399	672.850	2015.915	672.876	2018.431	672.903	2020.948	672.931	2023.466	672.960	2500	
2200	1758.921	591.994	1761.433	592.013	1763.946	592.035	1766.460	592.057	1768.974	592.080	1771.489	592.105	1774.005	592.131	1776.521	592.158	1779.038	592.186	1781.556	592.216	1784.075	592.246	1786.594	592.278	1789.114	592.311	2200	
2000	1602.674	538.206	1605.187	538.228	1607.701	538.250	1610.216	538.275	1612.732	538.301	1615.248	538.328	1617.765	538.356	1620.283	538.386	1622.802	538.417	1625.322	538.449	1627.843	538.483	1630.364	538.518	1632.886	538.554	2000	
1800	1446.428	484.421	1448.943	484.445	1451.458	484.471	1453.975	484.498	1456.492	484.526	1459.011	484.556	1461.530	484.588	1464.050	484.621	1466.571	484.656	1469.093	484.692	1471.615	484.729	1474.139	484.768	1476.664	484.808	1800	
1600	1212.065	403.753	1214.583	403.782	1217.102	403.813	1219.622	403.843	1222.143	403.880	1224.664	403.916	1227.188	403.954	1229.711	403.994	1232.237	404.035	1234.763	404.078	1237.290	404.123	1239.818	404.169	1242.348	404.218	1600	
1500	977.714	323.104	980.236	323.140	982.760	323.179	985.284	323.219	987.810	323.262	990.338	323.308	992.866	323.355	995.396	323.405	997.928	323.456	1000.460	323.510	1002.994	323.566	1005.529	323.625	1008.066	323.685	1500	
1400	821.491	269.356	824.018	269.400	826.546	269.446	829.075	269.495	831.606	269.547	834.139	269.601	836.673	269.658	839.209	269.718	841.747	269.779	844.285	269.844	846.826	269.912	849.368	269.982	851.911	270.054	1400	
1300	743.385	242.492	745.915	242.541	748.446	242.592	750.979	242.646	753.513	242.704	756.049	242.764	758.587	242.827	761.127	242.893	763.668	242.962	766.211	243.034	768.756	243.109	771.303	243.187	773.851	243.268	1300	
1200	665.285	215.637	667.818	215.692	670.353	215.750	672.889	215.811	675.428	215.875	677.969	215.943	680.512	216.014	683.056	216.089	685.603	216.166	688.151	216.247	690.701	216.331	693.253	216.419	695.807	216.510	1200	
1100	587.193	188.796	589.730	188.858	592.270	188.923	594.812	188.994	597.356	189.068	599.902	189.145	602.451	189.226	605.001	189.312	607.554	189.400	610.109	189.492	612.667	189.589	615.226	189.689	617.787	189.793	1100	
1000	509.112	161.973	511.656	162.048	514.202	162.125	516.750	162.206	519.302	162.292	521.855	162.382	524.412	162.477	526.971	162.576	529.532	162.680	532.096	162.787	534.662	162.900	537.231	163.016	539.802	163.137	1000	
900	431.031	135.186	433.602	135.273	436.157	135.363	438.716	135.463	441.277	135.566	443.841	135.675	446.408	135.788	448.978	135.907	451.550	136.031	454.127	136.160	456.706	136.295	459.287	136.433	461.872	136.580	900	
800	353.021	108.453	355.586	108.562	358.154	108.677	360.726	108.800	363.301	108.928	365.881	109.064	368.463	109.206	371.050	109.354	373.640	109.509	376.234	109.671	378.831	109.839	381.432	110.014	384.036	110.196	800	
700	321.825	97.786	324.396	97.907	326.971	98.036	329.551	98.171	332.134	98.314	334.722	98.465	337.313	98.622	339.908	98.787	342.508	98.959	345.111	99.139	347.719	99.326	350.329	99.520	352.944	99.721	700	100 (P)*
650	314.027	95.123	316.601	95.247	319.178	95.379	321.760	95.519	324.345	95.666	326.935	95.821	329.529	95.983	332.127	96.153	334.729	96.329	337.335	96.514	339.945	96.707	342.559	96.906	345.177	97.113	650	
600	275.056	81.833	277.640	81.978	280.230	82.132	282.824	82.295	285.423	82.466	288.027	82.646	290.635	82.835	293.248	83.033	295.866	83.240	298.488	83.455	301.115	83.679	303.746	83.912	306.381	84.153	600	
550	236.120	68.607	238.720	68.781	241.326	68.966	243.938	69.161	246.555	69.366	249.177	69.583	251.805	69.809	254.439	70.046	257.077	70.294	259.721	70.552	262.370	70.820	265.024	71.099	267.684	71.388	550	
500	220.560	63.344	223.169	63.533	225.783	63.734	228.404	63.946	231.030	64.169	233.662	64.404	236.300	64.650	238.944	64.908	241.593	65.177	244.248	65.457	246.908	65.748	249.574	66.051	252.245	66.365	500	80 (P)*
450	197.244	55.493	199.867	55.711	202.497	55.941	205.134	56.185	207.777	56.442	210.427	56.711	213.083	56.994	215.745	57.290	218.414	57.598	221.088	57.920	223.769	58.255	226.456	58.602	229.148	58.963	450	
400	173.968	47.720	176.610	47.975	179.261	48.246	181.919	48.532	184.584	48.834	187.256	49.151	189.935	49.483	192.622	49.830	195.315	50.192	198.016	50.570	200.722	50.962	203.436	51.370	206.155	51.793	400	
350	152.351	43.876	155.006	44.156	157.669	44.453	160.340	44.766	173.019	45.097	175.705	45.443	178.399	45.807	181.100	46.187	183.809	46.584	186.525	46.997	189.247	47.427	191.977	47.873	194.713	48.336	350	65 (P)*
325	139.185	36.325	141.871	36.671	144.567	37.038	147.271	37.425	149.985	37.833	152.707	38.262	155.437	38.710	158.176	39.179	160.922	39.669	163.676	40.178	166.438	40.707	169.207	41.257	171.983	41.826	325	
300	119.988	30.267	122.711	30.698	125.444	31.154	128.188	31.636	130.941	32.142	133.704	32.674	136.475	33.231	139.255	33.813	142.044	34.419	144.840	35.049	147.643	35.704	150.453	36.383	153.271	37.086	300	
280	112.332	27.945	115.094	28.423	117.847	28.928	120.610	29.461	123.383	30.022	126.165	30.611	128.957	31.226	131.757	31.869	134.564	32.539	137.380	33.235	140.202	33.958	143.031	34.706	145.866	35.481	280	50 (P)
260	104.753	25.714	107.517	26.249	110.291	26.815	113.077	27.412	115.872	28.039	118.676	28.697	121.489	29.385	124.310	30.103	127.139	30.850	129.974	31.627	132.815	32.433	135.663	33.266	138.515	34.127	260	50 (H)**
240	97.200	23.610	99.989	24.118	102.789	24.660	105.599	25.537	108.418	26.249	111.246	26.994	114.082	27.772	116.925	28.584	119.774	29.428	122.628	30.303	125.488	31.211	128.351	32.150	131.217	33.119	240	
220	89.710	21.692	92.527	22.395	95.354	23.138	98.190	23.919	101.035	24.738	103.886	25.596	106.743	26.490	109.606	27.421	112.471	28.388	115.340	29.389	118.210	30.423	121.080	31.495	123.950	32.598	220	40 (P)*
200	83.993	20.834	86.825	21.596	91.666	22.400	94.516	23.245	97.372	24.131	100.233	25.057	103.099	26.022	105.967	27.025	108.837	28.066	111.708	29.143	114.578	30.256	117.443	31.404	120.309	32.586	200	
190	82.299	20.066	85.145	20.897	88.000	21.773	90.861	22.693	93.726	23.656	96.593	24.662	99.465	25.708	102.333	26.794	105.204	27.919	108.079	29.082	110.932	30.282	113.788	31.517	116.636	32.786	190	40 (H)**
180	78.629	19.417	81.488	20.330	84.354	21.291	87.222	22.298	90.093	23.351	92.963	24.449	95.831	25.589	98.695	26.770	101.553	27.991	104.403	29.251	107.244	30.548	110.074	31.879	112.891	33.245	180	35 (P)*
170	74.981	18.925	77.850	19.935	80.729	20.997	83.590	22.108	86.456	23.266	89.317	24.470	92.170	25.718	95.013	27.008	97.843	28.337	100.659	29.705							170	40 (H)**
160	71.348	18.646	74.217	19.774	77.080	20.955	79.936	22.187	82.782	23.468	85.613	24.795															160	
150	67.702	18.611	72.758	19.792	75.613	21.027	78.457	22.314	81.285	23.649																	150	35 (P)*
140	64.042	18.661	70.550	19.930	73.385	21.253																					140	30 (H)**
130																											130	
120																											120	25 (H)**
110																											110	20 (P)*
100																											100	20 (H)**

*P – Plain & Rolling Terrain **H – Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 77 Degrees

$\Delta = 77°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
metre																												
2500	1996.091	694.451	1998.593	694.455	2001.096	694.460	2003.600	694.466	2006.104	694.473	2008.609	694.480	2011.115	694.490	2013.621	694.500	2016.128	694.511	2018.635	694.523	2021.144	694.536	2023.653	694.551	2026.162	694.566	2500	
2200	1757.461	611.118	1759.963	611.123	1762.467	611.128	1764.971	611.135	1767.476	611.143	1769.981	611.152	1772.488	611.162	1774.995	611.174	1777.503	611.186	1780.011	611.200	1782.521	611.215	1785.031	611.231	1787.542	611.249	2200	
2000	1598.374	555.563	1600.877	555.568	1603.381	555.574	1605.885	555.581	1608.391	555.590	1610.897	555.600	1613.404	555.611	1615.912	555.624	1618.420	555.638	1620.930	555.653	1623.440	555.670	1625.951	555.688	1628.463	555.707	2000	
1800	1439.287	500.008	1441.791	500.013	1444.295	500.020	1446.800	500.028	1449.306	500.038	1451.813	500.049	1454.321	500.062	1456.829	500.075	1459.339	500.091	1461.849	500.108	1464.361	500.127	1466.873	500.146	1469.386	500.168	1800	
1500	1200.658	416.676	1203.162	416.682	1205.667	416.690	1208.173	416.700	1210.680	416.711	1213.188	416.725	1215.697	416.740	1218.208	416.757	1220.719	416.775	1223.232	416.796	1225.746	416.818	1228.260	416.842	1230.776	416.868	1500	
1200	962.028	333.344	964.533	333.352	967.040	333.362	969.547	333.374	972.056	333.389	974.566	333.406	977.078	333.424	979.591	333.445	982.105	333.469	984.621	333.496	987.138	333.522	989.656	333.552	992.176	333.584	1200	
1000	802.943	277.791	805.448	277.800	807.956	277.812	810.465	277.827	812.976	277.844	815.488	277.864	818.002	277.886	820.518	277.912	823.035	277.940	825.553	277.970	828.074	278.004	830.596	278.039	833.120	278.078	1000	
900	723.400	250.014	725.906	250.024	728.415	250.038	730.925	250.054	733.437	250.073	735.950	250.095	738.465	250.121	740.983	250.149	743.502	250.180	746.023	250.214	748.546	250.251	751.070	250.291	753.597	250.334	900	
800	643.857	222.238	646.365	222.250	648.874	222.264	651.385	222.283	653.898	222.304	656.414	222.329	658.931	222.358	661.451	222.389	663.972	222.424	666.496	222.462	669.021	222.504	671.549	222.549	674.078	222.597	800	100 (P)*
700	564.315	194.462	566.824	194.476	569.334	194.492	571.847	194.513	574.362	194.538	576.880	194.567	579.400	194.599	581.922	194.635	584.446	194.675	586.973	194.719	589.502	194.766	592.034	194.818	594.567	194.873	700	
600	484.773	166.687	487.283	166.703	489.795	166.723	492.311	166.747	494.828	166.776	497.349	166.809	499.872	166.847	502.398	166.889	504.926	166.936	507.458	166.987	500.991	167.042	512.528	167.102	515.067	167.166	600	
500	405.232	138.913	407.744	138.932	410.259	138.956	412.777	138.985	415.298	139.020	417.823	139.060	420.350	139.105	422.881	139.156	425.415	139.211	427.953	139.273	430.493	139.339	433.037	139.411	435.583	139.488	500	
400	325.693	111.141	328.207	111.165	330.725	111.195	333.248	111.231	335.774	111.275	338.305	111.324	340.839	111.381	343.378	111.444	345.920	111.514	348.467	111.591	351.017	111.674	353.571	111.763	356.129	111.860	400	
360	293.877	100.034	296.393	100.060	298.914	100.093	301.438	100.134	303.968	100.182	306.502	100.237	309.040	100.300	311.583	100.370	314.130	100.448	316.681	100.532	319.237	100.625	321.797	100.725	324.361	100.832	360	
320	261.924	89.174	264.440	89.203	266.961	89.238	269.487	89.279	272.018	89.326	274.554	89.379	277.095	89.439	279.641	89.505	282.192	89.578	284.748	89.658	287.310	89.745	289.878	89.839	292.451	89.941	320	80 (P)*
300	246.155	83.774	248.674	83.805	251.199	83.845	253.729	83.893	256.264	83.951	258.804	84.017	261.350	84.093	263.901	84.177	266.457	84.270	269.018	84.372	271.584	84.483	274.156	84.603	276.732	84.731	300	
280	226.388	69.493	228.911	69.530	211.441	69.578	213.976	69.636	216.518	69.706	219.067	69.785	221.621	69.876	224.182	69.977	226.749	70.089	229.321	70.211	231.900	70.344	234.485	70.488	237.076	70.642	280	
250	190.482	63.941	193.007	63.983	195.539	64.034	198.078	64.097	200.623	64.173	203.176	64.259	205.735	64.358	208.300	64.468	210.873	64.589	213.452	64.722	216.037	64.866	218.629	65.022	221.227	65.190	250	
230	166.624	55.616	169.152	55.662	171.689	55.722	174.233	55.795	176.786	55.882	179.345	55.982	181.913	56.094	184.488	56.221	187.071	56.360	189.661	56.513	192.258	56.679	194.862	56.859	197.474	57.051	230	
200	142.767	47.293	145.301	47.348	147.844	47.418	150.395	47.504	152.957	47.606	155.527	47.723	158.105	47.856	160.693	48.005	163.289	48.169	165.894	48.349	168.507	48.544	171.128	48.755	173.758	48.981	200	65 (P)*
180	130.840	43.133	133.377	43.193	135.923	43.270	138.480	43.365	141.047	43.476	143.623	43.605	146.209	43.751	148.805	43.914	151.410	44.094	154.024	44.291	156.647	44.505	159.279	44.736	161.920	44.984	180	
160	106.988	34.818	109.533	34.893	112.091	34.988	114.661	35.103	117.243	35.244	119.836	35.403	122.441	35.584	125.058	35.786	127.686	36.009	130.326	36.253	132.974	36.518	135.634	36.804	138.304	37.110	160	
150	97.117	27.898	99.673	27.991	92.244	28.110	94.830	28.257	97.431	28.429	100.046	28.628	102.676	28.854	105.318	29.106	107.974	29.384	110.643	29.688	113.324	30.019	116.018	30.375	118.723	30.758	150	
140	87.170	25.133	81.732	25.237	84.311	25.370	86.906	25.532	89.518	25.724	92.144	25.945	94.780	26.195	97.443	26.475	100.114	26.784	102.799	27.121	105.497	27.488	108.208	27.883	110.932	28.307	140	50 (P)*
130	77.226	22.372	73.795	22.488	76.383	22.638	78.990	22.820	81.614	23.036	84.255	23.285	86.912	23.566	89.586	23.880	92.275	24.227	94.979	24.606	97.697	25.018	100.429	25.461	103.174	25.937	130	
120	67.284	19.616	65.863	19.749	68.463	19.919	71.083	20.128	73.723	20.374	76.382	20.658	79.058	20.979	81.753	21.337	84.464	21.735	87.191	22.165	89.933	22.633	92.690	23.138	95.461	23.679	120	
110	57.346	16.866	57.938	17.021	60.553	17.220	63.191	17.464	65.851	17.750	68.533	18.081	71.234	18.455	73.955	18.871	76.693	19.331	79.449	19.833	82.220	20.377	85.007	20.962	87.807	21.589	110	
100	51.380	13.495	53.979	15.665	56.603	15.882	59.251	16.147	61.926	16.459	64.621	16.819	67.337	17.226	70.073	17.680	72.828	18.180	75.600	18.726	78.389	19.317	81.197	19.953	84.009	20.633	100	
90	47.415	14.128	50.023	14.314	52.639	14.553	55.322	14.844	58.009	15.188	60.720	15.583	63.453	16.030	66.207	16.527	68.980	17.075	71.771	17.673	74.578	18.321	77.400	19.016	80.234	19.760	90	40 (H)**
80	43.453	12.766	46.072	13.072	48.732	13.237	51.429	12.561	54.104	13.942	56.834	14.380	59.587	14.875	62.361	15.425	65.154	16.032	67.965	16.692	70.792	17.407	73.633	18.174	76.485	18.992	80	35 (P)*
70	39.495	11.410	42.127	11.642	44.793	11.940	47.489	12.303	50.214	12.731	52.966	13.232	55.741	13.776	58.538	14.391	61.354	15.070	64.187	15.808	67.035	16.604	69.894	17.458	72.762	18.367	70	35 (H) 30 (P)*
65	37.541	10.064	38.191	10.329	40.876	10.669	43.596	11.082	46.345	11.569	49.122	12.128	51.923	12.758	54.746	13.457	57.586	14.224	60.441	15.057	63.308	15.955	66.183	16.915	69.064	17.936	65	
60	33.962	9.529	36.619	9.810	39.314	10.170	42.044	10.608	44.805	11.123	47.593	11.714	50.406	12.380	53.239	13.118	56.089	13.928	58.952	14.806	61.826	15.752	64.705	16.762	67.588	17.835	60	
55	31.595	8.732	34.266	9.040	36.977	9.436	39.724	9.916	42.503	10.481	45.310	11.128	48.140	11.856	50.990	12.662	53.854	13.544	56.728	14.499	59.609	15.525	62.491	16.619	65.371	17.777	55	30 (H)**
50	29.661	7.922	30.960	7.991	33.104	8.264	35.866	8.837	38.700	9.508	41.540	10.275	44.400	11.134	47.274	12.082	50.155	13.115	53.037	14.229	55.914	15.418	58.779	16.679	61.628	18.006	50	25 (P)*
45	26.992	6.908	26.805	7.309	31.564	7.820	34.362	8.441	37.192	9.167	40.046	9.994	42.916	10.919	45.796	11.938	48.678	13.044	51.555	14.234	54.420	15.500	57.265	16.838			45	
40	24.324	6.152	26.481	6.611	29.269	7.196	32.094	7.904	34.947	8.729	37.819	9.666	40.709	10.707	43.584	11.951	46.451	13.096	49.303	14.344							40	25 (H)**
35	21.655	5.452	23.653	5.964	25.655	6.531	28.364	7.249	31.246	8.309	34.122	9.493	36.977	10.803													35	20 (P)*
30	19.092	4.736	21.898	5.381	24.749	6.199	27.625	7.175	30.502	8.296	33.373	9.549															30	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE № : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 77 Degrees

$\Delta = 77°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metres	
2500	2028.672	694.583	2031.183	694.600	2033.695	694.619	2036.207	694.639	2038.720	694.660	2041.233	694.681	2043.747	694.704	2046.262	694.728	2048.778	694.753	2051.294	694.780	2053.811	694.807	2056.328	694.835	2058.846	694.864	2500	
2200	1780.053	611.268	1782.565	611.288	1795.079	611.309	1797.593	611.331	1800.107	611.355	1802.622	611.380	1805.138	611.406	1807.655	611.433	1810.173	611.461	1812.691	611.491	1815.210	611.522	1817.730	611.554	1820.250	611.587	2200	
2000	1630.976	555.728	1633.489	555.750	1636.004	555.773	1638.519	555.797	1641.035	555.823	1643.552	555.851	1646.069	555.879	1648.588	555.909	1651.107	555.941	1653.627	555.973	1656.148	556.007	1658.670	556.042	1661.192	556.079	2000	
1800	1471.900	500.191	1474.416	500.215	1476.931	500.241	1479.448	500.269	1481.966	500.297	1484.485	500.328	1487.004	500.359	1489.525	500.393	1492.046	500.427	1494.568	500.464	1497.091	500.501	1499.616	500.541	1502.141	500.581	1800	
1500	1233.293	418.893	1235.811	416.924	1238.331	416.956	1240.851	416.988	1243.372	417.023	1245.894	417.059	1248.418	417.097	1250.942	417.137	1253.468	417.179	1255.994	417.223	1258.522	417.268	1261.051	417.315	1263.581	417.364	1500	
1200	994.698	333.618	997.220	333.685	999.744	333.694	1002.269	333.735	1004.795	333.778	1007.323	333.823	1009.853	333.871	1012.383	333.921	1014.915	333.973	1017.448	334.028	1019.982	334.084	1022.519	334.143	1025.056	334.204	1200	
1000	835.645	278.119	838.172	278.163	840.701	278.210	843.230	278.259	845.762	278.311	848.296	278.365	850.831	278.423	853.367	278.483	855.905	278.545	858.445	278.610	860.986	278.678	863.529	278.749	866.073	278.822	1000	
900	756.125	250.379	758.655	250.428	761.186	250.480	763.719	250.534	766.255	250.592	768.792	250.653	771.330	250.716	773.871	250.783	776.413	250.852	778.957	250.925	781.503	251.000	784.050	251.079	786.599	251.160	900	
800	676.610	222.649	679.144	222.704	681.679	222.762	684.216	222.823	686.756	222.888	689.297	222.957	691.841	223.028	694.386	223.103	696.933	223.181	699.483	223.263	702.034	223.347	704.587	223.436	707.142	223.527	800	
700	597.103	194.932	599.641	194.994	602.182	195.061	604.725	195.131	607.270	195.206	609.817	195.283	612.366	195.365	614.918	195.451	617.472	195.540	620.028	195.633	622.586	195.730	625.146	195.831	627.709	195.935	700	
600	517.609	167.235	520.153	167.308	522.700	167.386	525.250	167.468	527.802	167.554	530.356	167.645	532.914	167.741	535.474	167.840	538.036	167.945	540.601	168.053	543.169	168.166	545.739	168.284	548.312	168.406	600	
500	438.133	139.571	440.666	139.658	443.242	139.751	445.802	139.850	448.366	139.954	450.929	140.063	453.497	140.177	456.068	140.297	458.643	140.422	461.220	140.552	463.801	140.688	466.384	140.829	468.970	140.975	500	
400	358.691	111.963	361.257	112.073	363.826	112.189	366.399	112.312	368.976	112.442	371.557	112.578	374.141	112.721	376.729	112.871	379.321	113.027	381.917	113.189	384.516	113.359	387.119	113.535	389.725	113.718	400	
360	326.929	100.947	329.502	101.068	332.079	101.198	334.659	101.334	337.244	101.478	339.834	101.630	342.427	101.788	345.024	101.954	347.626	102.128	350.231	102.309	352.840	102.497	355.453	102.692	358.071	102.895	360	100 (P)*
350	318.991	98.196	321.565	98.321	324.144	98.454	326.727	98.594	329.315	98.743	331.906	98.898	334.502	99.062	337.102	99.232	339.706	99.411	342.314	99.596	344.926	99.790	347.542	99.991	350.162	100.200	350	
300	279.313	84.469	281.900	84.615	284.491	84.770	287.087	84.934	289.688	85.106	292.294	85.288	294.904	85.478	297.519	85.678	300.139	85.885	302.764	86.102	305.393	86.328	308.027	86.562	310.665	86.805	300	
250	239.672	70.806	242.275	70.982	244.883	71.168	247.497	71.364	250.116	71.571	252.741	71.789	255.372	72.017	258.008	72.256	260.649	72.505	263.296	72.765	265.948	73.035	268.605	73.316	271.267	73.607	250	
230	223.831	65.369	226.442	65.560	229.058	65.761	231.681	65.975	234.310	66.200	236.945	66.437	239.585	66.684	242.232	66.944	244.884	67.214	247.542	67.497	250.206	67.790	252.875	68.095	255.550	68.411	230	80 (P)*
200	200.093	57.257	202.719	57.476	205.351	57.708	207.990	57.953	210.637	58.212	213.289	58.483	215.948	58.768	218.614	59.066	221.286	59.377	223.964	59.701	226.649	60.038	229.339	60.388	232.036	60.750	200	
170	176.396	49.223	179.041	49.480	181.694	49.753	184.355	50.041	187.024	50.345	189.700	50.663	192.383	50.998	195.073	51.347	197.771	51.712	200.475	52.092	203.185	52.488	205.904	52.898	208.628	53.324	170	
155	164.569	45.249	167.227	45.531	169.893	45.830	172.567	46.145	175.250	46.478	177.940	46.827	180.638	47.193	183.344	47.576	186.057	47.976	188.777	48.392	191.504	48.824	194.238	49.274	196.980	49.739	155	
125	140.984	37.438	143.674	37.787	146.373	38.156	149.082	38.547	151.800	38.957	154.527	39.389	157.263	39.841	160.006	40.313	162.758	40.805	165.518	41.318	168.286	41.851	171.061	42.404	173.843	42.978	125	
100	121.440	31.166	124.168	31.600	126.907	32.059	129.656	32.544	132.415	33.055	135.183	33.590	137.961	34.151	140.747	34.736	143.542	35.347	146.345	35.982	149.156	36.641	151.974	37.325	154.799	38.033	100	
90	113.668	28.759	116.415	29.240	119.173	29.749	121.942	30.286	124.721	30.851	127.510	31.443	130.309	32.063	133.115	32.710	135.931	33.385	138.754	34.086	141.584	34.813	144.421	35.567	147.265	36.347	90	50 (P)
80	105.932	26.444	108.701	26.982	111.482	27.552	114.274	28.153	117.076	28.785	119.888	29.448	122.709	30.140	125.538	30.863	128.375	31.615	131.219	32.397	134.069	33.208	136.926	34.047	139.787	34.915	80	30 (H)**
70	98.244	24.256	101.040	24.868	103.847	25.515	106.664	26.197	109.491	26.913	112.328	27.663	115.172	28.447	118.024	29.264	120.883	30.114	123.747	30.996	126.616	31.910	129.490	32.855	132.366	33.831	70	
60	90.620	22.256	93.445	22.964	96.281	23.712	99.126	24.498	101.980	25.323	104.841	26.187	107.708	27.087	110.580	28.024	113.457	28.998	116.337	30.006	119.218	31.050	122.101	32.127	124.983	33.237	60	40 (P)*
55	86.839	21.357	89.679	22.124	92.529	22.934	95.388	23.785	98.254	24.677	101.126	25.610	104.002	26.581	106.882	27.592	109.764	28.639	112.646	29.724	115.528	30.845	118.408	32.001	121.286	33.190	55	
50	83.080	20.550	85.936	21.387	88.800	22.269	91.671	23.195	94.547	24.165	97.427	25.177	100.309	26.230	103.192	27.324	106.073	28.457	108.952	29.628	111.827	30.836	114.697	32.080	117.559	33.358	50	40 (H)**
45	79.347	19.862	82.217	20.781	85.093	21.748	87.973	22.763	90.855	23.823	93.737	24.928	96.618	26.076	99.495	27.265	102.367	28.495	105.231	29.764	108.087	31.069	110.931	32.410	113.763	33.785	45	35 (P)*
40	75.638	19.132	78.518	20.349	81.400	21.618	84.282	22.936	87.162	23.703	90.035	24.915	92.903	26.172	95.760	27.470	98.605	28.809	101.436	30.186							40	30 (H)**
35	71.946	18.016	74.827	20.152	77.704	21.341	80.574	22.582	83.434	23.872	86.280	25.208															35	
33	70.469	18.967	73.346	20.156	76.215	21.400	79.073	22.696	81.917	24.040																	33	30 (P)*
30	68.244	18.997	71.107	20.275	73.954	21.607																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P - Plain & Rolling Terrain **H - Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 78 Degrees

$\Delta = 78°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2031.961	716.903	2034.463	716.907	2036.966	716.912	2039.470	716.918	2041.975	716.925	2044.479	716.933	2046.985	716.942	2049.492	716.952	2051.999	716.963	2054.506	716.976	2057.015	716.989	2059.524	717.004	2062.034	717.019	2500	
2200	1789.026	630.876	1791.529	630.880	1794.032	630.886	1796.537	630.893	1799.042	630.900	1801.547	630.910	1804.054	630.920	1806.561	630.932	1809.069	630.944	1811.578	630.958	1814.088	630.974	1816.598	630.990	1819.109	631.008	2200	
2000	1627.070	573.325	1629.573	573.330	1632.077	573.335	1634.582	573.543	1637.087	573.552	1639.594	573.362	1642.101	573.573	1644.608	573.586	1647.117	573.600	1649.627	573.615	1652.137	573.632	1654.649	573.650	1657.161	573.669	2000	
1800	1465.114	516.174	1467.617	516.179	1470.121	516.185	1472.626	516.194	1475.133	516.203	1477.640	516.215	1480.148	516.227	1482.656	516.241	1485.166	516.257	1487.677	516.274	1490.189	516.293	1492.701	516.313	1495.215	516.334	1800	
1500	1222.180	430.147	1224.684	430.154	1227.189	430.161	1229.695	430.171	1232.202	430.183	1234.711	430.196	1237.220	430.211	1239.731	430.228	1242.242	430.247	1244.755	430.268	1247.269	430.290	1249.784	430.314	1252.301	430.340	1500	
1200	978.246	344.121	981.751	344.129	984.257	344.139	986.765	344.151	989.274	344.166	991.785	344.183	994.296	344.202	996.810	344.223	999.324	344.246	1001.840	344.272	1004.358	344.300	1006.877	344.330	1009.397	344.363	1200	
1000	817.291	286.771	819.797	286.781	822.304	286.793	824.814	286.808	827.324	286.825	829.837	286.845	832.351	286.868	834.867	286.894	837.385	286.921	839.904	286.952	842.425	286.986	844.947	287.022	847.471	287.061	1000	
900	736.313	258.097	738.820	258.107	741.328	258.121	743.838	258.137	746.351	258.156	748.865	258.179	751.380	258.204	753.898	258.232	756.417	258.264	758.939	258.298	761.462	258.335	763.987	258.375	766.514	258.419	900	
800	655.336	229.423	657.843	229.434	660.353	229.449	662.864	229.468	665.378	229.490	667.894	229.515	670.411	229.543	672.931	229.575	675.453	229.610	677.977	229.649	680.503	229.690	683.031	229.736	685.561	229.784	800	
700	574.359	200.749	576.868	200.762	579.378	200.779	581.891	200.800	584.407	200.825	586.925	200.854	589.445	200.887	591.968	200.923	594.492	200.963	597.020	201.007	599.549	201.055	602.082	201.107	604.615	201.162	700	100 (P)*
600	493.383	172.076	495.892	172.092	498.405	172.112	500.920	172.136	503.438	172.165	505.959	172.198	508.483	172.237	511.009	172.279	513.538	172.326	516.070	172.377	518.604	172.433	521.142	172.494	523.681	172.558	600	
500	412.407	143.404	414.918	143.423	417.433	143.447	419.952	143.476	422.473	143.511	424.999	143.551	427.527	143.597	430.058	143.648	432.593	143.704	435.131	143.766	437.672	143.833	440.217	143.905	442.764	143.983	500	
450	331.432	114.734	333.947	114.758	336.466	114.788	338.989	114.824	341.515	114.868	344.047	114.918	346.582	114.975	349.121	115.039	351.664	115.109	354.211	115.186	356.762	115.270	359.317	115.360	361.876	115.457	450	
400	290.043	100.267	301.559	103.293	304.080	103.326	306.605	103.367	309.135	103.416	311.670	103.471	314.209	103.535	316.752	103.606	319.300	103.684	321.852	103.769	324.409	103.862	326.970	103.963	329.535	104.071	400	
350	290.946	100.400	293.462	100.427	295.984	100.462	298.510	100.504	301.041	100.553	303.576	100.611	306.116	100.676	308.661	100.749	311.210	100.829	313.764	100.917	316.322	101.013	318.885	101.116	321.452	101.227	350	
300	250.450	86.068	252.980	86.099	255.505	86.140	258.035	86.189	260.571	86.247	263.112	86.314	265.658	86.390	268.210	86.475	270.767	86.568	273.330	86.671	275.897	86.783	278.470	86.903	281.048	87.032	300	80 (P)*
250	209.976	71.738	212.499	71.776	215.029	71.824	217.565	71.883	220.108	71.952	222.657	72.033	225.213	72.124	227.775	72.226	230.343	72.338	232.917	72.461	235.497	72.595	238.084	72.740	240.676	72.895	250	
230	193.783	66.007	196.308	66.048	198.841	66.100	201.380	66.165	203.926	66.240	206.480	66.328	209.040	66.427	211.607	66.537	214.181	66.659	216.761	66.793	219.348	66.939	221.941	67.096	224.541	67.265	230	
200	169.464	57.412	172.023	57.459	174.560	57.519	177.106	57.593	179.659	57.680	182.220	57.781	184.789	57.895	187.365	58.022	189.949	58.162	192.541	58.316	195.140	58.483	197.747	58.664	200.361	58.858	200	
170	145.207	48.820	147.741	48.875	150.285	48.946	152.838	49.033	155.400	49.135	157.971	49.253	160.552	49.387	163.141	49.537	165.739	49.702	168.346	49.883	170.961	50.080	173.585	50.292	176.217	50.520	170	65 (P)*
155	133.065	44.526	135.602	44.586	138.150	44.664	140.708	44.759	143.275	44.871	145.853	45.001	148.441	45.148	151.038	45.312	153.645	45.493	156.262	45.691	158.887	45.907	161.522	46.140	164.165	46.389	155	
125	108.783	35.941	111.329	36.016	113.887	36.113	116.459	36.231	119.042	36.370	121.637	36.531	124.245	36.712	126.863	36.916	129.494	37.140	132.135	37.386	134.788	37.653	137.451	37.941	140.184	38.250	125	
100	88.533	28.797	91.110	28.890	93.683	29.011	96.270	29.138	98.873	29.332	101.491	29.533	104.122	29.760	106.768	30.013	109.427	30.293	112.099	30.600	114.784	30.933	117.482	31.292	120.192	31.677	100	
90	80.463	25.942	83.026	26.047	85.607	26.180	88.204	26.344	90.817	26.537	93.446	26.760	96.091	27.012	98.751	27.294	101.425	27.604	104.114	27.944	106.816	28.314	109.532	28.712	112.260	29.139	90	50 (P)*
80	72.375	23.092	74.946	23.209	77.526	23.359	80.144	23.543	82.771	23.760	85.414	24.011	88.075	24.294	90.752	24.610	93.445	24.960	96.153	25.341	98.876	25.756	101.613	26.202	104.364	26.681	80	50 (H)**
70	64.290	20.245	66.821	20.379	69.472	20.551	72.095	20.761	74.738	21.009	77.400	21.295	80.080	21.618	82.778	21.979	85.494	22.377	88.226	22.812	90.974	23.284	93.736	23.793	96.513	24.338	70	
60	56.210	17.406	58.802	17.563	61.420	17.763	64.061	18.008	66.724	18.297	69.409	18.630	72.115	19.006	74.840	19.426	77.584	19.888	80.345	20.394	83.123	20.942	85.916	21.531	88.723	22.162	60	40 (P)*
55	52.171	15.991	54.772	16.161	57.399	16.380	60.052	16.647	62.728	16.962	65.427	17.324	68.148	17.734	70.889	18.191	73.650	18.694	76.428	19.244	79.223	19.839	82.034	20.480	84.858	21.165	55	
50	48.135	14.579	50.745	14.766	53.384	15.007	56.050	15.300	58.741	15.646	61.457	16.044	64.195	16.494	66.954	16.995	69.734	17.547	72.531	18.149	75.345	18.801	78.175	19.501	81.017	20.250	50	40 (H)**
45	44.102	13.173	46.723	13.380	49.376	13.647	52.057	13.972	54.766	14.356	57.501	14.797	60.259	15.295	63.039	15.850	65.840	16.461	68.658	17.126	71.493	17.845	74.342	18.618	77.203	19.442	45	35 (P)*
40	40.072	11.772	42.707	12.005	45.376	12.305	48.077	12.671	50.807	13.101	53.563	13.556	56.345	14.154	59.149	14.775	61.973	15.457	64.814	16.200	67.670	17.002	70.539	17.862	73.418	18.778	40	35 (H) 30 (P)*
35	36.048	10.381	38.700	10.648	41.389	10.990	44.113	11.406	46.868	11.896	49.651	12.459	52.460	13.093	55.290	13.797	58.139	14.570	61.003	15.409	63.880	16.313	66.766	17.280	69.658	18.308	35	
33	34.440	9.828	37.100	10.111	39.799	10.473	42.534	10.915	45.300	11.433	48.095	12.029	50.915	12.699	53.757	13.443	56.616	14.258	59.489	15.142	62.373	16.094	65.264	17.112	68.159	18.192	33	
30	32.030	9.004	34.705	9.315	37.420	9.713	40.173	10.197	42.958	10.766	45.772	11.447	48.610	12.150	51.469	12.962	54.343	13.850	57.228	14.812	60.120	15.845	63.015	16.946	65.908	18.113	30	30 (H)**
25	28.025	7.650	30.728	8.022	33.477	8.497	36.266	9.075	39.087	9.751	41.936	10.523	44.806	11.388	47.690	12.343	50.583	13.383	53.477	14.504	56.367	15.702	59.247	16.972	62.111	18.308	25	
23	26.427	7.118	29.145	7.522	31.910	8.037	34.715	8.662	37.551*	9.393	40.416	10.226	43.297	11.158	46.189	12.183	49.083	13.298	51.973	14.495	54.852	15.771	57.713	17.118			23	25 (P)*
20	24.038	6.335	26.782	6.798	29.574	7.387	32.407	8.100	35.269	8.931	38.152	9.874	41.045	10.925	43.939	12.075	46.823	13.318	49.689	14.646							20	25 (H)**
15	20.046	5.098	22.886	5.709	25.734	6.481	28.614	7.406	31.507	8.473	34.397	9.671	37.267	10.985													15	20 (P)*
14	19.303	4.868	22.116	5.519	24.976	6.341	27.863	7.323	30.757	8.453	33.638	9.714															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 78 Degrees

$\Delta = 78°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=125 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	2064.544	717.036	2067.055	717.053	2069.567	717.072	2072.079	717.092	2074.592	717.113	2077.106	717.135	2079.620	717.158	2082.135	717.182	2084.651	717.207	2087.168	717.234	2089.685	717.261	2092.202	717.289	2094.721	717.319	2500	
2200	1821.621	631.026	1824.133	631.047	1826.646	631.068	1829.161	631.091	1831.676	631.115	1834.191	631.139	1836.707	631.166	1839.225	631.193	1841.742	631.221	1844.261	631.251	1846.780	631.282	1849.300	631.315	1851.821	631.348	2200	
2000	1659.674	573.690	1662.187	573.713	1664.702	573.736	1667.218	573.761	1669.734	573.787	1672.251	573.814	1674.769	573.843	1677.288	573.873	1679.808	573.905	1682.328	573.938	1684.849	573.972	1687.371	574.007	1689.894	574.044	2000	
1800	1497.729	516.358	1500.244	516.382	1502.760	516.408	1505.278	516.436	1507.796	516.465	1510.315	516.495	1512.835	516.527	1515.356	516.561	1517.877	516.596	1520.400	516.632	1522.924	516.670	1525.448	516.710	1527.974	516.750	1800	
1500	1254.818	430.368	1257.336	430.397	1259.856	430.429	1262.376	430.462	1264.898	430.497	1267.420	430.533	1269.945	430.572	1272.469	430.612	1274.995	430.654	1277.523	430.698	1280.051	430.743	1282.580	430.790	1285.111	430.840	1500	
1200	1011.918	344.397	1014.441	344.434	1016.965	344.473	1019.491	344.514	1022.018	344.558	1024.546	344.604	1027.076	344.652	1029.607	344.702	1032.140	344.755	1034.674	344.809	1037.208	344.866	1039.745	344.926	1042.283	344.987	1200	
1000	849.997	287.103	852.524	287.147	855.053	287.194	857.584	287.243	860.116	287.296	862.650	287.350	865.186	287.408	867.723	287.469	870.262	287.531	872.802	287.597	875.344	287.665	877.888	287.736	880.433	287.810	1000	
900	769.042	258.465	771.573	258.514	774.105	258.566	776.639	258.621	779.173	258.679	781.712	258.740	784.251	258.804	786.793	258.871	789.336	258.941	791.880	259.014	794.427	259.090	796.975	259.169	799.525	259.251	900	
800	688.093	229.836	690.627	229.892	693.164	229.950	695.701	230.012	698.242	230.078	700.784	230.146	703.328	230.218	705.874	230.294	708.422	230.372	710.973	230.455	713.525	230.540	716.079	230.629	718.635	230.721	800	
700	607.152	201.222	609.691	201.285	612.233	201.352	614.776	201.423	617.322	201.498	619.870	201.576	622.420	201.658	624.973	201.744	627.528	201.834	630.084	201.928	632.644	202.026	635.205	202.127	637.769	202.232	700	
600	526.224	172.627	528.769	172.701	531.317	172.780	533.867	172.862	536.421	172.949	538.976	173.041	541.535	173.137	544.096	173.237	546.659	173.342	549.226	173.451	551.794	173.565	554.366	173.684	556.940	173.806	600	
500	445.315	144.066	447.869	144.154	450.426	144.248	452.986	144.347	455.550	144.452	458.116	144.562	460.686	144.677	463.258	144.797	465.834	144.923	468.413	145.054	470.995	145.191	473.580	145.333	476.167	145.480	500	
400	364.439	115.561	367.007	115.672	369.577	115.789	372.152	115.913	374.730	116.043	377.313	116.181	379.898	116.324	382.489	116.475	385.082	116.632	387.679	116.796	390.280	116.967	392.885	117.144	395.494	117.328	400	
360	332.105	104.186	334.679	104.309	337.257	104.439	339.840	104.577	342.426	104.721	345.017	104.874	347.613	105.034	350.211	105.201	352.815	105.376	355.422	105.558	358.034	105.748	360.649	105.944	363.268	106.148	360	100 (P)*
300	324.023	101.346	326.599	101.472	329.180	101.606	331.765	101.747	334.354	101.897	336.947	102.053	339.544	102.218	342.146	102.390	344.752	102.569	347.362	102.756	349.977	102.952	352.595	103.154	355.218	103.364	350	
300	283.631	87.171	286.219	87.318	288.812	87.474	291.409	87.639	294.012	87.813	296.620	87.996	299.233	88.188	301.850	88.388	304.472	88.598	307.099	88.816	309.731	89.043	312.367	89.279	315.008	89.524	300	
250	243.275	73.061	245.879	73.238	248.489	73.425	251.105	73.623	253.727	73.831	256.354	74.051	258.988	74.280	261.626	74.521	264.270	74.772	266.920	75.033	269.575	75.305	272.235	75.588	274.901	75.882	250	
230	227.148	67.445	229.760	67.637	232.379	67.840	235.005	68.055	237.636	68.282	240.273	68.520	242.917	68.770	245.566	69.031	248.222	69.303	250.883	69.587	253.550	69.883	256.222	70.190	258.900	70.509	230	80 (P)*
200	202.982	59.065	205.610	59.286	208.245	59.519	210.887	59.766	213.536	60.027	216.192	60.300	218.854	60.587	221.523	60.887	224.199	61.200	226.881	61.526	229.569	61.865	232.263	62.218	234.964	62.583	200	
170	178.857	50.764	181.506	51.023	184.162	51.297	186.826	51.587	189.498	51.893	192.177	52.214	194.864	52.551	197.559	52.903	200.260	53.270	202.969	53.653	205.684	54.051	208.407	54.465	211.136	54.893	170	
155	166.818	46.656	169.479	46.940	172.148	47.241	174.826	47.559	177.512	47.894	180.206	48.246	182.909	48.614	185.618	49.000	188.336	49.402	191.061	49.821	193.793	50.257	196.532	50.709	199.279	51.178	155	65 (P)*
125	142.808	38.580	145.502	38.931	148.206	39.303	150.919	39.696	153.641	40.110	156.373	40.544	159.113	40.999	161.863	41.475	164.620	41.971	167.386	42.487	170.159	43.024	172.941	43.581	175.729	44.158	125	
100	122.913	32.088	125.646	32.525	128.390	32.987	131.144	33.476	133.909	33.990	136.683	34.529	139.467	35.094	142.260	35.683	145.062	36.298	147.872	36.937	150.691	37.601	153.516	38.290	156.349	39.002	100	
90	115.001	29.594	117.754	30.078	120.518	30.591	123.293	31.132	126.078	31.700	128.874	32.297	131.679	32.921	134.493	33.573	137.316	34.252	140.147	34.958	142.986	35.691	145.831	36.450	148.684	37.235	90	50 (P)
80	107.127	27.192	109.903	27.734	112.690	28.308	115.489	28.914	118.298	29.550	121.117	30.217	123.945	30.914	126.783	31.642	129.628	32.400	132.481	33.187	135.340	34.004	138.206	34.849	141.078	35.723	80	50 (H)**
70	99.303	24.918	102.105	25.535	104.919	26.186	107.744	26.873	110.580	27.594	113.424	28.350	116.278	29.139	119.139	29.962	122.007	30.818	124.881	31.706	127.760	32.626	130.645	33.578	133.532	34.560	70	
60	91.544	22.835	94.377	23.547	97.221	24.300	100.075	25.092	102.938	25.923	105.808	26.792	108.686	27.699	111.569	28.643	114.456	29.623	117.347	30.639	120.241	31.690	123.135	32.774	126.030	33.893	60	40 (P)*
55	87.696	21.894	90.545	22.667	93.404	23.482	96.273	24.339	99.149	25.237	102.031	26.176	104.918	27.155	107.809	28.172	110.703	29.227	113.598	30.320	116.492	31.448	119.385	32.612	122.276	33.810	55	
50	83.872	21.046	86.738	21.888	89.612	22.777	92.493	23.709	95.380	24.686	98.271	25.705	101.165	26.766	104.060	27.868	106.954	29.009	109.846	30.188	112.735	31.404	115.618	32.657	118.495	33.943	50	40 (H)**
45	80.073	20.318	82.955	21.243	85.842	22.217	88.734	23.239	91.628	24.307	94.522	25.419	97.416	26.573	100.306	27.773	103.192	29.012	106.071	30.289	108.941	31.604	111.800	32.954	114.648	34.339	45	35 (P)*
40	76.304	19.749	79.196	20.773	82.090	21.850	84.985	22.976	87.877	24.150	90.765	25.371	93.646	26.637	96.518	27.944	99.378	29.293	102.225	30.679							40	30 (H)**
35	72.551	19.396	75.447	20.539	78.337	21.737	81.221	22.987	84.095	24.286	86.956	25.631															35	
33	71.053	19.332	73.943	20.530	76.826	21.783	79.699	23.087	82.557	24.441																	33	30 (P)*
30	68.795	19.341	71.671	20.628	74.534	21.969																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 79 Degrees

$\Delta = 79°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2068.342	739.920	2070.844	739.924	2073.347	739.929	2075.851	739.935	2078.356	739.942	2080.861	739.950	2083.366	739.959	2085.873	739.969	2088.380	739.981	2090.888	739.993	2093.396	740.007	2095.906	740.021	2098.416	740.037	2500	
2250	1821.042	651.131	1823.544	651.135	1826.048	651.141	1828.552	651.148	1831.057	651.156	1833.563	651.165	1836.070	651.175	1838.577	651.187	1841.085	651.200	1843.594	651.214	1846.104	651.229	1848.614	651.246	1851.126	651.263	2250	
2000	1656.173	591.938	1658.678	591.943	1661.182	591.949	1663.687	591.957	1666.192	591.966	1668.698	591.976	1671.206	591.987	1673.714	592.000	1676.223	592.014	1678.733	592.030	1681.243	592.047	1683.755	592.064	1686.267	592.084	2000	
1800	1491.308	532.746	1493.812	532.751	1496.316	532.758	1498.821	532.766	1501.327	532.776	1503.834	532.787	1506.343	532.800	1508.851	532.814	1511.361	532.830	1513.872	532.847	1516.384	532.866	1518.897	532.886	1521.411	532.908	1800	
1500	1244.009	443.958	1246.512	443.964	1249.018	443.972	1251.524	443.981	1254.031	443.993	1256.540	444.007	1259.049	444.022	1261.560	444.039	1264.072	444.058	1266.585	444.079	1269.100	444.101	1271.615	444.126	1274.131	444.152	1500	
1200	996.799	355.169	999.214	355.177	1001.720	355.188	1004.228	355.200	1006.738	355.214	1009.248	355.231	1011.760	355.250	1014.274	355.272	1016.789	355.295	1019.305	355.321	1021.823	355.350	1024.342	355.380	1026.862	355.413	1200	
1000	831.863	295.978	834.349	295.988	836.857	296.000	839.366	296.015	841.877	296.032	844.390	296.052	846.905	296.076	849.421	296.101	851.939	296.129	854.458	296.160	856.979	296.194	859.502	296.231	862.027	296.270	1000	
900	749.411	266.383	751.917	266.394	754.426	266.407	756.936	266.424	759.448	266.443	761.963	266.465	764.479	266.491	766.997	266.520	769.517	266.551	772.038	266.586	774.562	266.623	777.087	266.664	779.615	266.707	900	
800	666.978	236.788	669.486	236.800	671.995	236.815	674.507	236.834	677.021	236.855	679.537	236.881	682.055	236.910	684.575	236.942	687.097	236.977	689.622	237.016	692.148	237.058	694.677	237.104	697.207	237.153	800	100 (P)*
700	584.546	207.194	587.055	207.207	589.565	207.224	592.079	207.246	594.595	207.271	597.113	207.300	599.634	207.333	602.156	207.369	604.682	207.409	607.210	207.454	609.740	207.502	612.272	207.554	614.807	207.610	700	
600	502.114	177.600	504.624	177.616	507.137	177.636	509.653	177.661	512.171	177.690	514.692	177.724	517.216	177.762	519.743	177.805	522.272	177.852	524.805	177.904	527.340	177.960	529.878	178.021	532.418	178.086	600	
500	419.683	148.007	422.195	148.026	424.710	148.051	427.229	148.080	429.751	148.115	432.277	148.156	434.805	148.202	437.337	148.253	439.873	148.310	442.411	148.372	444.953	148.439	447.499	148.512	450.047	148.591	500	
450	337.253	118.417	339.768	118.441	342.287	118.471	344.811	118.508	347.338	118.552	349.870	118.603	352.406	118.660	354.946	118.724	357.490	118.795	360.038	118.873	362.590	118.957	365.146	119.048	367.706	119.146	450	
400	304.782	106.582	306.799	106.608	309.320	106.641	311.846	106.683	314.376	106.732	316.911	106.788	319.451	106.852	321.995	106.923	324.544	107.001	327.097	107.088	329.655	107.181	332.217	107.282	334.784	107.391	400	
350	296.040	103.623	298.556	103.650	301.078	103.685	303.605	103.727	306.136	103.777	308.672	103.835	311.213	103.900	313.759	103.974	316.309	104.055	318.863	104.143	321.423	104.240	323.986	104.344	326.555	104.456	350	
300	254.926	88.830	257.346	88.862	259.872	88.903	262.402	88.952	264.939	89.010	267.481	89.078	270.028	89.154	272.581	89.240	275.139	89.334	277.703	89.438	280.271	89.550	282.845	89.671	285.425	89.802	300	80 (P)
250	213.613	74.040	216.138	74.078	218.669	74.126	221.206	74.186	223.749	74.256	226.299	74.337	228.856	74.429	231.419	74.531	233.988	74.645	236.564	74.769	239.146	74.904	241.734	75.049	244.328	75.206	250	
230	197.131	68.125	199.656	68.166	202.189	68.219	204.729	68.283	207.277	68.360	209.831	68.448	212.392	68.547	214.961	68.659	217.536	68.782	220.117	68.917	222.706	69.063	225.301	69.222	227.903	69.392	230	
200	172.405	59.234	174.933	59.301	177.473	59.382	180.019	59.476	182.573	59.524	185.135	59.625	187.705	59.740	190.283	59.868	192.869	60.009	195.462	60.165	198.063	60.333	200.672	60.515	203.288	60.710	200	
170	147.682	50.386	150.217	50.441	152.761	50.513	155.315	50.600	157.878	50.703	160.451	50.822	163.033	50.957	165.624	51.108	168.224	51.274	170.832	51.456	173.450	51.655	176.076	51.868	178.711	52.098	170	65 (P)*
155	135.721	45.953	137.859	46.014	140.408	46.092	142.967	46.188	145.536	46.301	148.115	46.432	150.705	46.580	153.304	46.745	155.913	46.927	158.531	47.127	161.159	47.344	163.796	47.579	166.443	47.830	155	
125	110.603	37.093	113.150	37.169	115.709	37.266	118.282	37.384	120.867	37.525	123.464	37.686	126.073	37.870	128.695	38.074	131.327	38.300	133.972	38.548	136.627	38.817	139.293	39.107	141.970	39.418	125	
100	90.009	29.711	92.568	29.813	95.142	29.934	97.731	30.082	100.336	30.257	102.956	30.459	105.590	30.688	108.238	30.944	110.901	31.226	113.576	31.534	116.265	31.869	118.967	32.231	121.681	32.619	100	
90	81.774	26.772	84.339	26.877	86.921	27.012	89.519	27.176	92.135	27.371	94.767	27.595	97.414	27.849	100.077	28.133	102.755	28.446	105.448	28.788	108.154	29.160	110.874	29.561	113.608	29.991	90	50 (P)*
80	73.541	23.829	76.113	23.947	78.705	24.099	81.315	24.284	83.944	24.503	86.591	24.755	89.255	25.040	91.935	25.359	94.632	25.711	97.345	26.095	100.072	26.512	102.814	26.962	105.570	27.444	80	50 (H)**
70	65.311	20.891	67.893	21.026	70.497	21.199	73.121	21.411	75.767	21.660	78.432	21.948	81.116	22.274	83.819	22.637	86.539	23.038	89.276	23.477	92.029	23.952	94.797	24.464	97.580	25.013	70	
60	57.085	17.980	59.680	18.118	62.299	18.320	64.943	18.566	67.610	18.857	70.299	19.192	73.008	19.571	75.738	19.994	78.487	20.460	81.254	20.969	84.038	21.521	86.838	22.115	89.653	22.750	60	40 (P)*
55	52.974	16.499	55.577	16.670	58.207	16.891	60.862	17.159	63.542	17.477	66.245	17.842	68.971	18.254	71.717	18.715	74.483	19.222	77.268	19.775	80.070	20.375	82.887	21.020	85.720	21.710	55	
50	48.866	15.041	51.478	15.230	54.119	15.472	56.788	15.767	59.483	16.115	62.203	16.516	64.947	16.970	67.712	17.474	70.497	18.030	73.302	18.637	76.123	19.293	78.961	19.999	81.812	20.753	50	40 (H)**
45	44.760	13.588	47.383	13.798	50.039	14.066	52.724	14.394	55.437	14.781	58.177	15.225	60.941	15.727	63.727	16.286	66.535	16.900	69.361	17.570	72.204	18.295	75.061	19.073	77.932	19.903	45	35 (P)*
40	40.658	12.142	43.295	12.377	45.968	12.679	48.672	13.048	51.407	13.481	54.170	13.970	56.959	14.545	59.768	15.167	62.600	15.854	65.450	16.607	68.315	17.410	71.193	18.276	74.082	19.198	40	35 (H) 30 (P)*
35	36.561	10.705	39.216	10.974	41.909	11.319	44.638	11.738	47.398	12.232	50.188	12.799	53.003	13.437	55.842	14.146	58.699	14.924	61.573	15.769	64.461	16.680	67.357	17.654	70.261	18.690	35	
33	34.924	10.134	37.588	10.419	40.291	10.784	43.030	11.229	45.803	11.751	48.604	12.351	51.432	13.026	54.282	13.775	57.153	14.596	60.034	15.487	62.928	16.446	65.831	17.470	68.738	18.558	33	
30	32.471	9.283	35.149	9.596	37.869	9.997	40.627	10.483	43.419	11.057	46.240	11.714	49.087	12.452	51.955	13.269	54.839	14.163	57.735	15.132	60.639	16.173	63.546	17.282	66.452	18.457	30	30 (H)**
25	29.765	7.863	31.102	8.238	33.856	8.737	36.651	9.318	39.480	9.999	42.338	10.777	45.217	11.649	48.112	12.610	51.017	13.658	53.924	14.787	56.828	15.993	59.722	17.272	62.601	18.618	25	
23	26.768	7.333	29.490	7.760	32.261	8.259	35.073	8.888	37.919	9.624	40.792	10.464	43.684	11.402	46.587	12.435	49.494	13.557	52.398	14.764	55.291	16.048	58.166	17.405			23	25 (P)*
20	24.336	6.524	27.085	6.990	29.884	7.583	32.725	8.301	35.592	9.138	38.490	10.088	41.395	11.146	44.301	12.305	47.209	13.557	50.081	14.894							20	25 (H)**
15	20.314	5.242	23.120	5.857	25.977	6.634	28.867	7.566	31.773	8.641	34.676	9.847	37.581	11.171													15	20 (P)*
14	19.516	5.003	22.337	5.639	25.206	6.487	28.104	7.476	31.011	8.613	33.906	9.884															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 18 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 79 Degrees

$\Delta = 79°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2100.927	740.054	2103.438	740.071	2105.950	740.090	2108.462	740.110	2110.976	740.132	2113.490	740.154	2116.004	740.177	2118.520	740.201	2121.035	740.226	2123.552	740.253	2126.070	740.281	2128.587	740.309	2131.106	740.339	2500	
2200	1853.637	651.282	1856.150	651.303	1858.664	651.324	1861.178	651.347	1863.694	651.371	1866.209	651.396	1868.726	651.423	1871.243	651.450	1873.761	651.479	1876.280	651.509	1878.800	651.540	1881.321	651.573	1883.842	651.606	2200	
2000	1688.781	592.105	1691.294	592.127	1693.809	592.151	1696.325	592.176	1698.842	592.202	1701.359	592.230	1703.877	592.259	1706.396	592.289	1708.917	592.321	1711.437	592.354	1713.959	592.388	1716.481	592.424	1719.005	592.461	2000	
1800	1523.925	532.931	1526.441	532.956	1528.958	532.982	1531.475	533.010	1533.993	533.039	1536.513	533.070	1539.033	533.102	1541.554	533.136	1544.076	533.171	1546.600	533.208	1549.123	533.246	1551.648	533.286	1554.175	533.327	1800	
1500	1276.649	444.179	1279.167	444.209	1281.688	444.241	1284.208	444.274	1286.730	444.309	1289.253	444.345	1291.778	444.385	1294.303	444.425	1296.830	444.468	1299.357	444.512	1301.886	444.558	1304.416	444.605	1306.947	444.655	1500	
1200	1029.384	355.447	1031.908	355.485	1034.432	355.524	1036.958	355.565	1039.486	355.609	1042.015	355.656	1044.545	355.704	1047.077	355.755	1049.610	355.807	1052.144	355.862	1054.680	355.920	1057.217	355.979	1059.756	356.041	1200	
1000	864.553	296.312	867.081	296.356	869.611	296.403	872.142	296.453	874.675	296.506	877.209	296.561	879.746	296.620	882.283	296.680	884.823	296.744	887.364	296.810	889.907	296.879	892.451	296.950	894.997	297.024	1000	
900	782.144	266.754	784.675	266.803	787.208	266.855	789.742	266.911	792.278	266.969	794.817	267.031	797.357	267.095	799.899	267.163	802.443	267.233	804.988	267.307	807.536	267.383	810.085	267.463	812.636	267.545	900	
800	699.740	237.205	702.275	237.260	704.812	237.320	707.350	237.382	709.891	237.448	712.434	237.517	714.979	237.590	717.526	237.666	720.075	237.745	722.626	237.827	725.179	237.913	727.735	238.003	730.292	238.095	800	
700	617.344	207.670	619.884	207.733	622.426	207.801	624.970	207.872	627.517	207.948	630.066	208.026	632.617	208.109	635.171	208.196	637.727	208.287	640.285	208.381	642.845	208.479	645.408	208.582	647.973	208.688	700	
600	534.962	178.136	537.508	178.230	540.056	178.309	542.608	178.392	545.162	178.479	547.719	178.572	550.279	178.668	552.841	178.770	555.406	178.875	557.973	178.985	560.543	179.100	563.116	179.219	565.691	179.343	600	
500	452.599	148.674	455.154	148.763	457.712	148.858	460.273	148.958	462.838	149.063	465.406	149.173	467.976	149.289	470.551	149.411	473.128	149.538	475.708	149.669	478.291	149.807	480.878	149.950	483.468	150.098	500	
400	370.270	119.250	372.838	119.361	375.410	119.479	377.987	119.604	380.566	119.736	383.150	119.874	385.738	120.019	388.330	120.171	390.925	120.329	393.524	120.494	396.127	120.666	398.734	120.844	401.344	121.030	400	
360	337.355	107.508	339.930	107.631	342.510	107.762	345.094	107.901	347.682	108.047	350.275	108.200	352.872	108.361	355.473	108.530	358.078	108.706	360.687	108.889	363.301	109.080	365.918	109.278	368.540	109.484	360	100 (P)*
350	329.128	104.575	331.705	104.702	334.287	104.837	336.874	104.980	339.464	105.130	342.059	105.288	344.659	105.453	347.262	105.627	349.870	105.807	352.483	105.996	355.099	106.192	357.720	106.396	360.345	106.608	350	
300	288.009	89.941	290.599	90.089	293.194	90.247	295.793	90.413	298.398	90.588	301.008	90.772	303.623	90.965	306.242	91.167	308.867	91.378	311.497	91.598	314.131	91.827	316.770	92.064	319.414	92.311	300	
250	246.928	75.373	249.535	75.551	252.147	75.739	254.765	75.938	257.389	76.148	260.019	76.369	262.655	76.601	265.296	76.843	267.943	77.095	270.596	77.359	273.254	77.633	275.917	77.918	278.587	78.213	250	
230	230.512	69.573	233.126	69.766	235.748	69.971	238.375	70.188	241.009	70.416	243.649	70.656	246.296	70.907	248.948	71.170	251.607	71.445	254.271	71.731	256.941	72.029	259.617	72.338	262.299	72.659	230	80 (P)*
200	205.911	60.919	208.542	61.141	211.180	61.376	213.825	61.625	216.477	61.887	219.135	62.163	221.801	62.451	224.474	62.753	227.153	63.069	229.838	63.397	232.530	63.739	235.229	64.094	237.934	64.462	200	
170	181.354	52.343	184.005	52.604	186.665	52.881	189.332	53.173	192.007	53.481	194.691	53.804	197.381	54.143	200.080	54.498	202.785	54.868	205.498	55.253	208.218	55.654	210.945	56.071	213.679	56.502	170	
155	169.098	48.099	171.762	48.385	174.435	48.688	177.117	49.008	179.807	49.346	182.505	49.700	185.211	50.071	187.925	50.459	190.648	50.865	193.377	51.287	196.114	51.726	198.859	52.181	201.611	52.653	155	65 (P)*
125	144.658	39.790	147.356	40.104	150.064	40.479	152.781	40.874	155.509	41.291	158.245	41.729	160.991	42.187	163.745	42.666	166.508	43.165	169.280	43.686	172.060	44.226	174.847	44.787	177.642	45.369	125	
100	124.407	33.033	127.145	33.473	129.894	33.939	132.654	34.431	135.424	34.949	138.205	35.492	140.995	36.060	143.795	36.654	146.604	37.273	149.421	37.917	152.247	38.586	155.080	39.279	157.921	39.997	100	
90	116.354	30.450	119.112	30.937	121.882	31.454	124.663	31.998	127.455	32.571	130.257	33.172	133.069	33.801	135.891	34.457	138.721	35.141	141.560	35.852	144.407	36.590	147.261	37.355	150.123	38.146	90	50 (P)
80	108.339	27.999	111.121	28.505	113.915	29.083	116.720	29.691	119.537	30.334	122.363	31.006	125.200	31.708	128.045	32.441	130.899	33.204	133.761	33.997	136.630	34.819	139.505	35.671	142.387	36.551	80	50 (H)**
70	100.376	25.597	103.185	26.218	106.007	26.875	108.840	27.566	111.685	28.293	114.537	29.054	117.399	29.849	120.269	30.677	123.147	31.539	126.031	32.433	128.921	33.360	131.816	34.319	134.715	35.309	70	
60	92.481	23.427	95.322	24.145	98.174	24.903	101.037	25.701	103.909	26.538	106.790	27.413	109.678	28.327	112.571	29.277	115.470	30.264	118.372	31.288	121.278	32.346	124.184	33.438	127.092	34.564	60	40 (P)*
55	88.566	22.444	91.423	23.222	94.292	24.043	97.170	24.906	100.056	25.811	102.949	26.757	105.847	27.742	108.750	28.767	111.655	29.830	114.563	30.930	117.470	32.067	120.376	33.239	123.280	34.445	55	
50	84.676	21.534	87.551	22.403	90.435	23.297	93.327	24.237	96.225	25.220	99.128	26.247	102.033	27.316	104.941	28.425	107.848	29.574	110.753	30.762	113.655	31.987	116.553	33.248	119.444	34.544	50	40 (H)**
45	80.814	20.765	83.705	21.717	86.602	22.698	89.505	23.727	92.411	24.803	95.319	25.923	98.225	27.088	101.129	28.294	104.029	29.541	106.922	30.828	109.807	32.152	112.682	33.512	115.545	34.906	45	35 (P)*
40	76.980	20.176	79.883	21.208	82.790	22.292	85.697	23.426	88.603	24.699	91.504	25.839	94.400	27.113	97.286	28.431	100.162	29.788	103.024	31.185							40	30 (H)**
35	73.168	19.785	76.075	20.937	78.979	22.143	81.876	23.402	84.765	24.710	87.641	26.065															35	
33	71.645	19.707	74.548	20.913	77.446	22.175	80.333	23.489	83.207	24.852																	33	30 (P)*
30	69.353	19.694	72.244	20.990	75.121	22.341																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

△=80°

Table 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 80 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	2105.249	763.321	2107.752	763.525	2110.255	763.730	2112.759	763.936	2115.263	763.543	2117.769	763.551	2120.275	763.560	2122.781	763.571	2125.289	763.583	2127.796	763.595	2130.305	763.608	2132.815	763.623	2135.325	763.639	2500	
2200	1853.520	671.900	1856.023	671.904	1858.527	671.910	1861.031	671.917	1863.536	671.925	1866.042	671.934	1868.549	671.945	1871.056	671.956	1873.565	671.969	1876.074	671.983	1878.584	671.999	1881.094	672.016	1883.606	672.033	2200	
2000	1685.701	610.819	1688.204	610.824	1690.708	610.830	1693.213	610.838	1695.719	610.847	1698.225	610.857	1700.732	610.868	1703.241	610.881	1705.750	610.895	1708.260	610.911	1710.771	610.928	1713.282	610.946	1715.795	610.966	2000	
1800	1517.882	549.739	1520.385	549.744	1522.889	549.751	1525.395	549.759	1527.901	549.769	1530.408	549.780	1532.917	549.793	1535.426	549.807	1537.936	549.823	1540.447	549.841	1542.959	549.860	1545.472	549.880	1547.986	549.902	1800	
1500	1266.153	458.118	1268.657	458.125	1271.162	458.133	1273.669	458.142	1276.176	458.154	1278.685	458.168	1281.195	458.183	1283.706	458.200	1286.218	458.219	1288.731	458.240	1291.246	458.263	1293.761	458.288	1296.278	458.314	1500	
1200	1014.425	366.498	1016.930	366.506	1019.437	366.516	1021.944	366.529	1024.454	366.543	1026.965	366.561	1029.477	366.580	1031.991	366.601	1034.506	366.625	1037.022	366.651	1039.541	366.679	1042.060	366.710	1044.581	366.743	1200	
1000	846.606	305.419	849.113	305.428	851.620	305.441	854.130	305.456	856.641	305.473	859.154	305.494	861.669	305.517	864.186	305.543	866.703	305.571	869.223	305.602	871.745	305.636	874.268	305.673	876.793	305.713	1000	
900	762.698	274.880	765.204	274.890	767.713	274.904	770.223	274.920	772.736	274.940	775.250	274.962	777.767	274.988	780.285	275.017	782.805	275.049	785.327	275.083	787.851	275.121	790.377	275.162	792.905	275.206	900	
800	678.789	244.341	681.296	244.352	683.806	244.368	686.318	244.386	688.832	244.408	691.348	244.434	693.867	244.463	696.387	244.495	698.910	244.531	701.435	244.570	703.962	244.612	706.491	244.658	709.022	244.708	800	
700	594.886	213.802	597.389	213.816	599.900	213.833	602.414	213.854	604.930	213.880	607.448	213.909	609.969	213.942	612.493	213.979	615.019	214.020	617.547	214.064	620.078	214.113	622.611	214.166	625.146	214.221	700	100 (P)*
600	510.972	183.264	513.482	183.280	515.995	183.301	518.511	183.325	521.030	183.355	523.552	183.389	526.076	183.427	528.603	183.470	531.133	183.518	533.667	183.570	536.202	183.627	538.741	183.688	541.282	183.754	600	
500	427.065	152.728	429.577	152.747	432.093	152.771	434.612	152.801	437.134	152.836	439.660	152.877	442.189	152.924	444.722	152.975	447.258	153.032	449.797	153.095	452.340	153.163	454.886	153.236	457.436	153.315	500	
400	343.159	122.193	345.674	122.217	348.194	122.248	350.717	122.285	353.245	122.329	355.778	122.380	358.314	122.438	360.855	122.503	363.399	122.574	365.948	122.652	368.501	122.737	371.059	122.829	373.620	122.927	400	
360	309.597	109.980	312.114	110.007	314.635	110.041	317.162	110.083	319.693	110.132	322.229	110.188	324.769	110.252	327.314	110.324	329.864	110.403	332.418	110.490	334.977	110.584	337.540	110.686	340.108	110.796	360	
350	301.207	106.927	303.724	106.954	306.247	106.990	308.773	107.032	311.305	107.083	313.842	107.141	316.384	107.207	318.930	107.281	321.481	107.362	324.037	107.452	326.597	107.549	329.162	107.653	331.732	107.766	350	
300	259.256	91.663	261.776	91.695	264.302	91.735	266.833	91.785	269.370	91.844	271.913	91.912	274.461	91.989	277.015	92.075	279.574	92.170	282.139	92.274	284.709	92.388	287.284	92.510	289.865	92.641	300	80 (P)*
250	217.306	76.401	219.830	76.439	222.361	76.488	224.899	76.547	227.443	76.618	229.994	76.700	232.552	76.792	235.116	76.895	237.686	77.010	240.263	77.135	242.847	77.270	245.437	77.417	248.033	77.574	250	
230	200.527	70.297	203.053	70.338	205.586	70.391	208.127	70.456	210.675	70.533	213.231	70.622	215.793	70.722	218.363	70.834	220.939	70.958	223.523	71.094	226.113	71.242	228.710	71.401	231.314	71.573	230	
200	173.359	61.143	177.889	61.190	180.427	61.251	182.974	61.326	185.529	61.414	188.093	61.516	190.664	61.632	193.243	61.761	195.831	61.903	198.426	62.060	201.029	62.229	203.640	62.412	206.258	62.609	200	
170	150.193	51.991	152.728	52.047	155.273	52.119	157.828	52.207	160.392	52.311	162.966	52.431	165.550	52.567	168.143	52.718	170.744	52.886	173.355	53.070	175.975	53.269	178.604	53.485	181.241	53.716	170	65 (P)*
155	137.610	47.417	140.149	47.478	142.699	47.557	145.259	47.654	147.829	47.768	150.410	47.899	153.001	48.046	155.602	48.214	158.213	48.398	160.834	48.600	163.464	48.818	166.104	49.054	168.753	49.308	155	
125	112.449	38.274	114.997	38.350	117.558	38.448	120.132	38.567	122.718	38.708	125.317	38.871	127.929	39.056	130.552	39.262	133.188	39.490	135.835	39.739	138.493	40.010	141.163	40.302	143.843	40.616	125	
100	91.487	30.663	94.046	30.758	96.622	30.880	99.213	31.030	101.820	31.206	104.442	31.410	107.079	31.640	109.730	31.897	112.395	32.182	115.075	32.492	117.767	32.830	120.473	33.194	123.192	33.585	100	
90	83.105	27.623	85.670	27.728	88.233	27.864	90.854	28.030	93.472	28.226	96.106	28.452	98.757	28.709	101.423	29.000	104.105	29.309	106.801	29.654	109.512	30.028	112.236	30.432	114.975	30.865	90	50 (P)*
80	74.724	24.585	77.297	24.704	79.891	24.857	82.503	25.044	85.134	25.264	87.784	25.518	90.451	25.805	93.135	26.126	95.836	26.481	98.553	26.865	101.286	27.288	104.033	27.741	106.794	28.227	80	50 (H)**
70	66.346	21.553	68.930	21.682	71.535	21.864	74.163	22.077	76.811	22.328	79.479	22.618	82.167	22.946	84.874	23.312	87.599	23.716	90.340	24.157	93.099	24.636	95.873	25.152	98.662	25.705	70	
60	57.973	18.528	60.570	18.687	63.191	18.890	65.838	19.138	68.508	19.432	71.201	19.769	73.915	20.151	76.650	20.577	79.404	21.046	82.177	21.559	84.967	22.115	87.773	22.713	90.595	23.353	60	40 (P)*
55	53.789	17.020	56.393	17.192	59.025	17.414	61.684	17.685	64.367	18.004	67.075	18.372	69.805	18.788	72.557	19.252	75.329	19.762	78.120	20.320	80.928	20.924	83.753	21.574	86.594	22.269	55	
50	49.607	15.515	52.221	15.705	54.865	15.949	57.537	16.246	60.237	16.597	62.961	17.001	65.710	17.457	68.483	17.966	71.272	18.526	74.084	19.137	76.913	19.798	79.758	20.508	82.618	21.268	50	40 (H)**
45	45.427	14.015	48.053	14.226	50.712	14.497	53.401	14.827	56.118	15.216	58.863	15.663	61.635	16.169	64.436	16.732	67.240	17.351	70.073	18.026	72.925	18.756	75.791	19.540	78.671	20.376	45	35 (P)*
40	41.252	12.522	43.892	12.759	46.568	13.063	49.277	13.434	52.016	13.871	54.785	14.373	57.579	14.939	60.397	15.569	63.236	16.261	66.094	17.014	68.969	17.828	71.857	18.700	74.757	19.629	40	35 (H) 30 (P)*
35	37.081	11.038	39.740	11.309	42.437	11.656	45.170	12.079	47.936	12.576	50.732	13.147	53.555	13.790	56.402	14.504	59.268	15.288	62.152	16.139	65.049	17.057	67.957	18.038	70.872	19.081	35	
33	35.415	10.449	38.082	10.736	40.789	11.103	43.534	11.551	46.312	12.077	49.121	12.681	51.956	13.361	54.815	14.116	57.692	14.943	60.586	15.840	63.492	16.806	66.406	17.838	69.325	18.934	33	
30	32.919	9.569	35.600	9.885	38.325	10.288	41.088	10.779	43.887	11.356	46.716	12.018	49.571	12.761	52.446	13.584	55.342	14.485	58.249	15.461	61.165	16.509	64.085	17.627	67.004	18.810	30	30 (H)**
25	28.769	8.123	31.481	8.500	34.240	8.983	37.042	9.568	39.879	10.254	42.745	11.036	45.635	11.916	48.541	12.884	51.457	13.919	54.377	15.007	57.295	16.292	60.204	17.560	63.098	18.935	25	
23	27.113	7.584	29.841	7.964	32.617	8.487	35.437	9.121	38.291	9.862	41.173	10.706	44.075	11.653	47.000	12.693	49.940	13.824	52.828	15.039	55.736	16.333	58.627	17.699			23	25 (P)*
20	24.638	6.717	27.392	7.186	30.198	7.784	33.047	8.507	35.929	9.361	38.843	10.307	41.780	11.373	44.739	12.540	47.712	13.801	50.478	15.148							20	25 (H)**
15	20.544	5.390	23.358	6.009	26.224	6.792	29.125	7.710	32.042	8.813	34.959	10.028	37.859	11.401													15	20 (P)*
14	19.732	5.141	22.561	5.802	25.440	6.636	28.349	7.632	31.269	8.778	34.178	10.058															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 80 Degrees

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=80°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2137.835	763.656	2140.347	763.674	2142.859	763.693	2145.372	763.713	2147.885	763.734	2150.400	763.756	2152.915	763.780	2155.430	763.804	2157.947	763.830	2160.464	763.856	2162.981	763.884	2165.500	763.913	2168.019	763.943	2500	
2200	1886.118	672.052	1888.631	672.073	1891.145	672.094	1893.659	672.117	1896.175	672.142	1898.691	672.167	1901.208	672.194	1903.726	672.221	1906.244	672.250	1908.763	672.281	1911.283	672.312	1913.804	672.345	1916.326	672.379	2200	
2000	1718.308	610.987	1720.823	611.010	1723.338	611.033	1725.854	611.059	1728.371	611.085	1730.889	611.113	1733.407	611.142	1735.927	611.173	1738.447	611.205	1740.968	611.238	1743.490	611.273	1746.013	611.309	1748.537	611.346	2000	
1800	1550.501	549.925	1553.017	549.950	1555.534	549.977	1558.052	550.005	1560.570	550.034	1563.090	550.065	1565.611	550.097	1568.132	550.132	1570.655	550.167	1573.178	550.204	1575.703	550.242	1578.228	550.282	1580.755	550.324	1800	
1500	1298.796	458.342	1301.315	458.372	1303.835	458.404	1306.357	458.437	1308.879	458.473	1311.402	458.510	1313.927	458.549	1316.453	458.590	1318.980	458.632	1321.508	458.677	1324.038	458.723	1326.568	458.771	1329.099	458.821	1500	
1200	1047.103	366.778	1049.627	366.815	1052.152	366.855	1054.679	366.897	1057.207	366.941	1059.736	366.988	1062.267	367.036	1064.799	367.087	1067.333	367.141	1069.868	367.196	1072.404	367.254	1074.942	367.314	1077.481	367.376	1200	
1000	879.320	305.755	881.849	305.800	884.379	305.847	886.910	305.897	889.444	305.951	891.979	306.006	894.516	306.065	897.054	306.126	899.595	306.190	902.137	306.256	904.680	306.326	907.225	306.398	909.772	306.472	1000	
900	795.435	275.253	797.966	275.302	800.500	275.355	803.035	275.411	805.572	275.470	808.111	275.532	810.652	275.597	813.194	275.665	815.739	275.736	818.285	275.810	820.834	275.887	823.384	275.967	825.936	276.050	900	
800	711.555	244.760	714.091	244.816	716.628	244.876	719.167	244.939	721.709	245.005	724.253	245.075	726.799	245.148	729.347	245.224	731.897	245.304	734.449	245.387	737.003	245.474	739.559	245.564	742.117	245.657	800	
700	627.684	214.282	630.225	214.346	632.767	214.414	635.312	214.486	637.860	214.562	640.410	214.641	642.962	214.724	645.517	214.812	648.073	214.903	650.633	214.998	653.194	215.097	655.758	215.200	658.324	215.307	700	
600	543.826	183.824	546.373	183.899	548.923	183.978	551.475	184.062	554.030	184.150	556.588	184.243	559.149	184.341	561.712	184.443	564.278	184.549	566.847	184.660	569.418	184.775	571.992	184.896	574.569	185.020	600	
500	459.988	153.399	462.544	153.489	465.103	153.584	467.666	153.685	470.232	153.791	472.801	153.902	475.373	154.019	477.948	154.141	480.527	154.269	483.109	154.402	485.694	154.541	488.282	154.685	490.873	154.834	500	
400	376.185	123.033	378.755	123.145	381.328	123.263	383.906	123.389	386.487	123.521	389.073	123.661	391.662	123.807	394.255	123.960	396.852	124.119	399.453	124.285	402.058	124.458	404.667	124.638	407.280	124.825	400	
360	342.680	110.913	345.257	111.037	347.838	111.169	350.424	111.309	353.014	111.456	355.608	111.611	358.207	111.773	360.810	111.943	363.417	112.120	366.029	112.304	368.644	112.497	371.264	112.697	373.888	112.904	360	100 (P)*
350	334.306	107.886	336.885	108.014	339.469	108.150	342.056	108.294	344.649	108.445	347.246	108.604	349.847	108.771	352.453	108.946	355.063	109.128	357.677	109.318	360.296	109.516	362.919	109.721	365.546	109.934	350	
300	292.451	92.782	295.042	92.931	297.639	93.089	300.241	93.257	302.847	93.433	305.459	93.619	308.076	93.813	310.698	94.017	313.325	94.229	315.957	94.450	318.594	94.681	321.236	94.920	323.883	95.169	300	
250	250.635	77.743	253.243	77.922	255.858	78.112	258.478	78.313	261.104	78.524	263.737	78.747	266.375	78.980	269.020	79.224	271.669	79.478	274.325	79.744	276.986	80.020	279.653	80.306	282.325	80.604	250	
230	233.924	71.753	236.541	71.950	239.165	72.156	241.795	72.375	244.432	72.604	247.074	72.846	249.724	73.099	252.379	73.364	255.040	73.641	257.708	73.929	260.382	74.229	263.061	74.540	265.747	74.863	230	80 (P)*
200	208.884	62.819	211.517	63.043	214.157	63.280	216.805	63.531	219.460	63.795	222.122	64.072	224.791	64.363	227.467	64.667	230.149	64.985	232.839	65.316	235.535	65.660	238.237	66.018	240.946	66.388	200	
170	183.887	53.963	186.541	54.226	189.204	54.504	191.874	54.799	194.553	55.109	197.240	55.435	199.935	55.776	202.637	56.133	205.347	56.506	208.064	56.894	210.789	57.298	213.521	57.718	216.260	58.152	170	
155	171.412	49.579	174.079	49.867	176.756	50.172	179.441	50.494	182.135	50.834	184.837	51.191	187.547	51.565	190.266	51.956	192.993	52.364	195.727	52.789	198.469	53.231	201.219	53.690	203.976	54.166	155	65 (P)*
125	146.535	40.951	149.237	41.307	151.949	41.684	154.671	42.083	157.403	42.502	160.144	42.943	162.895	43.405	165.655	43.887	168.424	44.390	171.202	44.914	173.987	45.459	176.781	46.024	179.583	46.610	125	
100	125.922	34.002	128.665	34.445	131.419	34.915	134.185	35.410	136.961	35.932	139.748	36.479	142.545	37.051	145.352	37.650	148.167	38.273	150.992	38.922	153.825	39.595	156.667	40.294	159.516	41.017	100	
90	117.726	31.327	120.489	31.818	123.265	32.338	126.053	32.887	128.851	33.464	131.660	34.069	134.480	34.703	137.309	35.364	140.147	36.052	142.994	36.769	145.849	37.512	148.712	38.282	151.582	39.079	90	50 (P)
80	109.569	28.745	112.357	29.296	115.158	29.878	117.970	30.492	120.794	31.137	123.628	31.814	126.472	32.522	129.326	33.260	132.189	34.029	135.059	34.827	137.938	35.656	140.823	36.513	143.714	37.400	80	50 (H)**
70	101.465	26.294	104.281	26.919	107.111	27.580	109.951	28.277	112.803	29.009	115.665	29.775	118.536	30.576	121.416	31.411	124.304	32.279	127.198	33.180	130.099	34.113	133.004	35.079	135.914	36.076	70	
60	93.431	24.035	96.280	24.758	99.141	25.522	102.013	26.325	104.895	27.168	107.786	28.050	110.684	28.970	113.588	29.928	116.498	30.922	119.412	31.952	122.329	33.018	125.249	34.119	128.169	35.253	60	40 (P)*
55	89.448	23.008	92.314	23.792	95.192	24.619	98.080	25.489	100.977	26.400	103.880	27.352	106.790	28.345	109.704	29.377	112.622	30.448	115.541	31.556	118.462	32.701	121.381	33.882	124.299	35.097	55	
50	85.491	22.076	88.375	22.930	91.270	23.831	94.172	24.778	97.082	25.768	99.996	26.802	102.914	27.879	105.834	28.996	108.754	30.154	111.673	31.350	114.589	32.584	117.501	33.854	120.407	35.160	50	40 (H)**
45	81.563	21.264	84.465	22.203	87.374	23.191	90.288	24.228	93.207	25.311	96.127	26.440	99.047	27.613	101.964	28.828	104.878	30.084	107.786	31.380	110.686	32.714	113.576	34.084	116.455	35.488	45	35 (P)*
40	77.665	20.615	80.580	21.654	83.499	22.746	86.419	23.889	89.339	25.080	92.254	26.319	95.164	27.602	98.066	28.929	100.957	30.297	103.835	31.703							40	30 (H)**
35	73.792	20.184	76.712	21.344	79.630	22.559	82.542	23.827	85.445	25.145	88.337	26.510															35	
33	72.245	20.091	75.163	21.306	78.074	22.577	80.977	23.900	83.866	25.273																	33	30 (P)*
30	69.919	20.056	72.825	21.362	75.717	22.723																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 81 Degrees

Δ=81°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2142.702	787.721	2145.205	787.725	2147.708	787.730	2150.212	787.736	2152.717	787.743	2155.222	787.751	2157.728	787.760	2160.235	787.771	2162.742	787.782	2165.250	787.795	2167.759	787.808	2170.269	787.823	2172.779	787.839	2500	
2200	1886.479	693.196	1888.982	693.200	1891.485	693.205	1893.990	693.212	1896.495	693.220	1899.001	693.230	1901.508	693.240	1904.016	693.252	1906.524	693.265	1909.033	693.280	1911.543	693.295	1914.054	693.312	1916.566	693.330	2200	
2000	1715.663	630.179	1718.166	630.184	1720.670	630.190	1723.175	630.198	1725.681	630.207	1728.188	630.217	1730.695	630.228	1733.204	630.241	1735.713	630.256	1738.223	630.271	1740.734	630.289	1743.246	630.307	1745.759	630.327	2000	
1800	1544.848	567.162	1547.351	567.168	1549.855	567.174	1552.361	567.183	1554.867	567.193	1557.375	567.204	1559.883	567.217	1562.393	567.231	1564.903	367.248	1567.414	567.265	1569.927	567.284	1572.440	567.305	1574.954	567.327	1800	
1500	1288.625	472.638	1291.129	472.644	1293.634	472.652	1296.140	472.662	1298.648	472.674	1301.157	472.688	1303.667	472.703	1306.178	472.721	1308.691	472.740	1311.204	472.761	1313.719	472.784	1316.235	472.809	1318.752	472.835	1500	
1200	1032.402	378.114	1034.907	378.122	1037.414	378.132	1039.922	378.145	1042.432	378.159	1044.943	378.177	1047.455	378.196	1049.969	378.218	1052.485	378.242	1055.001	378.268	1057.520	378.297	1060.040	378.327	1062.561	378.361	1200	
1000	861.588	315.099	864.094	315.108	866.602	315.121	869.112	315.136	871.623	315.154	874.136	315.174	876.651	315.198	879.168	315.223	881.687	315.252	884.207	315.283	886.729	315.318	889.252	315.355	891.778	315.395	1000	
900	776.181	283.592	778.687	283.602	781.197	283.616	783.707	283.633	786.220	283.652	788.735	283.675	791.251	283.701	793.770	283.730	796.291	283.762	798.813	283.797	801.337	283.835	803.864	283.876	806.392	283.920	900	
800	690.774	252.084	693.281	252.096	695.792	252.112	698.303	252.131	700.818	252.155	703.334	252.178	705.853	252.208	708.374	255.240	710.897	252.276	713.422	252.316	715.950	252.358	718.479	252.405	721.011	252.454	800	
700	605.367	220.578	607.876	220.592	610.387	220.609	612.901	220.631	615.418	220.656	617.937	220.686	620.458	220.719	622.982	220.756	625.508	220.797	628.037	220.842	630.568	220.891	633.102	220.944	635.638	221.001	700	100 (P)*
600	519.961	189.072	522.471	189.088	524.985	189.109	527.501	189.134	530.020	189.164	532.542	189.198	535.067	189.237	537.594	189.280	540.125	189.328	542.659	189.381	545.195	189.438	547.735	189.499	550.277	189.565	600	
500	434.556	157.568	437.068	157.587	439.584	157.612	442.103	157.642	444.626	157.677	447.153	157.719	449.682	157.765	452.216	157.817	454.752	157.875	457.292	157.938	459.836	158.006	462.383	158.080	464.933	158.160	500	
400	349.152	126.065	351.667	126.089	354.187	126.120	356.711	126.158	359.240	126.202	361.772	126.254	364.310	126.312	366.851	126.377	369.396	126.449	371.947	126.528	374.500	126.613	377.059	126.706	379.621	126.805	400	
360	314.991	113.465	317.508	113.492	320.030	113.526	322.557	113.568	325.088	113.618	327.625	113.675	330.166	113.739	332.712	113.812	335.262	113.892	337.818	113.979	340.377	114.074	342.942	114.177	345.511	114.287	360	
350	306.451	110.315	308.968	110.343	311.491	110.378	314.018	110.421	316.551	110.472	319.088	110.531	321.630	110.597	324.178	110.672	326.730	110.754	329.286	110.844	331.848	110.942	334.414	111.047	336.985	111.161	350	
300	263.750	94.567	266.271	94.599	268.797	94.640	271.329	94.690	273.867	94.750	276.411	94.818	278.960	94.896	281.515	94.982	284.075	95.078	286.641	95.183	289.212	95.297	291.789	95.420	294.371	95.553	300	80 (P)*
250	221.052	78.821	223.576	78.839	226.108	78.908	228.646	78.969	231.191	79.040	233.743	79.122	236.302	79.215	238.867	79.319	241.439	79.434	244.018	79.560	246.603	79.697	249.194	79.845	251.792	80.003	250	
230	203.973	72.523	206.500	72.565	209.034	72.619	211.575	72.684	214.124	72.762	216.681	72.851	219.244	72.952	221.815	73.065	224.393	73.190	226.978	73.327	229.570	73.476	232.169	73.636	234.775	73.809	230	
200	178.356	63.079	180.886	63.127	183.425	63.188	185.973	63.264	188.529	63.353	191.094	63.456	193.667	63.572	196.247	63.702	198.836	63.845	201.433	64.003	204.038	64.174	206.651	64.358	209.272	64.556	200	
170	152.740	53.637	155.276	53.694	157.822	53.766	160.378	53.855	162.944	53.959	165.519	54.080	168.104	54.217	170.698	54.370	173.302	54.539	175.915	54.724	178.537	54.925	181.168	55.142	183.808	55.375	170	65 (P)*
155	139.933	48.918	142.473	48.980	145.023	49.059	147.584	49.156	150.156	49.271	152.738	49.404	155.331	49.554	157.934	49.721	160.547	49.907	163.170	50.109	165.803	50.330	168.446	50.567	171.098	50.823	155	
125	114.323	39.484	116.872	39.561	119.434	39.660	122.009	39.780	124.597	39.922	127.198	40.087	129.812	40.272	132.437	40.480	135.075	40.710	137.725	40.961	140.387	41.233	143.060	41.528	145.744	41.844	125	
100	92.967	31.632	95.547	31.728	98.124	31.851	100.717	32.001	103.326	32.179	105.950	32.384	108.589	32.616	111.244	32.875	113.912	33.162	116.595	33.475	119.292	33.815	122.002	34.182	124.725	34.575	100	
90	84.454	28.495	87.021	28.601	89.606	28.738	92.209	28.905	94.829	29.103	97.466	29.330	100.119	29.588	102.789	29.876	105.474	30.193	108.174	30.541	110.889	30.918	113.619	31.325	116.362	31.761	90	50 (P)*
80	75.924	25.361	78.499	25.481	81.094	25.635	83.709	25.823	86.342	26.045	88.995	26.300	91.665	26.590	94.353	26.913	97.058	27.270	99.780	27.660	102.517	28.084	105.269	28.540	108.036	29.030	80	50 (H)**
70	67.397	22.232	69.982	22.369	72.590	22.545	75.219	22.759	77.871	23.013	80.542	23.305	83.234	23.635	85.945	24.004	88.674	24.411	91.421	24.856	94.185	25.338	96.965	25.858	99.760	26.414	70	
60	58.874	19.111	61.473	19.270	64.097	19.475	66.746	19.725	69.420	20.021	72.116	20.361	74.835	20.745	77.574	21.174	80.334	21.647	83.113	22.164	85.909	22.723	88.723	23.326	91.552	23.971	60	40 (P)*
55	54.615	17.554	57.222	17.728	59.857	17.951	62.518	18.224	65.205	18.546	67.917	18.916	70.652	19.335	73.409	19.802	76.187	20.317	78.984	20.878	81.800	21.487	84.632	22.142	87.480	22.842	55	
50	50.358	16.001	52.975	16.192	55.622	16.438	58.298	16.737	61.001	17.091	63.730	17.498	66.484	17.958	69.261	18.470	72.059	19.034	74.877	19.649	77.714	20.315	80.567	21.031	83.436	21.796	50	40 (H)**
45	46.104	14.453	48.733	14.665	51.394	14.938	54.087	15.270	56.809	15.663	59.559	16.113	62.335	16.623	65.134	17.190	67.955	17.814	70.797	18.494	73.656	19.229	76.532	20.018	79.422	20.861	45	35 (P)*
40	41.854	12.911	44.497	13.150	47.177	13.457	49.890	13.830	52.635	14.270	55.409	14.776	58.209	15.346	61.035	15.981	63.882	16.678	66.749	17.437	69.632	18.257	72.531	19.135	75.441	20.072	40	35 (H) 30 (P)*
35	37.610	11.380	40.271	11.652	42.972	12.002	45.711	12.428	48.482	12.929	51.285	13.504	54.115	14.152	56.970	14.871	59.845	15.661	62.739	16.519	65.647	17.443	68.566	18.431	71.493	19.482	35	
33	35.914	10.771	38.584	11.060	41.296	11.430	44.045	11.881	46.830	12.412	49.645	13.020	52.488	13.705	55.355	14.465	58.243	15.298	61.146	16.202	64.063	17.175	66.989	18.215	69.921	19.319	33	
30	33.373	9.863	36.058	10.180	38.787	10.587	41.556	11.082	44.361	11.663	47.198	12.329	50.061	13.078	52.948	13.907	55.852	14.815	58.771	15.798	61.699	16.854	64.631	17.980	67.564	19.172	30	30 (H)**
25	29.149	8.369	31.865	8.749	34.630	9.235	37.439	9.825	40.284	10.516	43.159	11.305	46.059	12.189	48.976	13.165	51.904	14.228	54.837	15.374	57.769	16.598	60.692	17.896	63.602	19.261	25	
23	27.464	7.781	30.196	8.194	32.979	8.720	35.805	9.359	38.668	10.106	41.560	10.958	44.473	11.910	47.400	12.958	50.333	14.097	53.264	15.321	56.187	16.624	59.094	18.001			23	25 (P)*
20	24.945	6.915	27.704	7.388	30.517	7.990	33.374	8.719	36.265	9.568	39.181	10.532	42.110	11.606	45.043	12.781	47.970	14.052	50.882	15.409							20	25 (H)**
15	20.778	5.541	23.599	6.165	26.474	6.954	29.385	7.899	32.316	8.990	35.247	10.214	38.161	11.557													15	20 (P)*
14	19.952	5.283	22.788	5.949	25.676	6.789	28.597	7.793	31.530	8.947	34.454	10.236															14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 81 Degrees

△=81°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2175.290	787.856	2177.801	787.874	2180.314	787.894	2182.827	787.914	2185.341	787.935	2187.855	787.958	2190.370	787.981	2192.886	788.006	2195.403	788.031	2197.920	788.059	2200.438	788.086	2202.957	788.115	2205.476	788.146	2500	
2200	1919.078	693.349	1921.591	693.370	1924.105	693.392	1926.620	693.415	1929.136	693.439	1931.652	693.465	1934.170	693.491	1936.688	693.520	1939.207	693.549	1941.726	693.579	1944.247	693.611	1946.768	693.644	1949.290	693.678	2200	
2000	1748.272	630.348	1750.787	630.371	1753.302	630.395	1755.819	630.420	1758.336	630.447	1760.854	630.475	1763.373	630.504	1765.893	630.535	1768.414	630.567	1770.935	630.601	1773.458	630.636	1775.981	630.672	1778.505	630.709	2000	
1800	1577.469	567.350	1579.985	567.375	1582.502	567.402	1585.021	567.430	1587.540	567.460	1590.060	567.491	1592.581	567.524	1595.103	567.558	1597.626	567.594	1600.150	567.631	1602.674	567.670	1605.200	567.710	1607.727	567.752	1800	
1500	1321.270	472.863	1323.790	472.894	1326.311	472.926	1328.832	472.959	1331.355	472.995	1333.879	473.032	1336.404	473.072	1338.930	473.113	1341.458	473.156	1343.987	473.200	1346.516	473.247	1349.047	473.295	1351.579	473.345	1500	
1200	1065.084	378.396	1067.608	378.434	1070.134	378.473	1072.661	378.516	1075.189	378.560	1077.719	378.607	1080.250	378.656	1082.783	378.708	1085.318	378.761	1087.853	378.817	1090.390	378.875	1092.929	378.936	1095.469	378.999	1200	
1000	894.305	315.437	896.834	315.482	899.365	315.530	901.897	315.581	904.431	315.635	906.967	315.690	909.505	315.749	912.044	315.811	914.585	315.875	917.127	315.942	919.672	316.012	922.218	316.085	924.765	316.160	1000	
900	808.922	283.968	811.454	284.018	813.988	284.071	816.524	284.127	819.062	284.187	821.602	284.249	824.143	284.314	826.687	284.383	829.232	284.454	831.779	284.529	834.329	284.606	836.879	284.687	839.432	284.771	900	
800	723.545	252.507	726.081	252.564	728.619	252.624	731.159	252.687	733.702	252.754	736.247	252.824	738.793	252.898	741.342	252.975	743.893	253.055	746.446	253.139	749.001	253.226	751.558	253.317	754.117	253.411	800	
700	638.177	221.061	640.718	221.126	643.261	221.195	645.807	221.267	648.355	221.343	650.906	221.423	653.459	221.507	656.015	221.595	658.573	221.687	661.133	221.783	663.696	221.883	666.261	221.987	668.828	222.094	700	
600	552.821	189.636	555.369	189.712	557.920	189.792	560.473	189.876	563.029	189.965	565.588	190.058	568.150	190.156	570.714	190.259	573.281	190.367	575.852	190.478	578.424	190.594	581.000	190.716	583.578	190.841	600	
500	467.487	158.244	470.043	158.335	472.604	158.431	475.168	158.532	477.735	158.639	480.305	158.751	482.878	158.869	485.455	158.992	488.035	159.121	490.619	159.254	493.205	159.394	495.795	159.539	498.388	159.689	500	
400	382.188	126.911	384.758	127.024	387.333	127.144	389.912	127.270	392.495	127.404	395.082	127.544	397.673	127.691	400.268	127.845	402.867	128.006	405.470	128.173	408.077	128.347	410.688	128.529	413.302	128.717	400	
360	348.083	114.405	350.663	114.530	353.246	114.663	355.833	114.804	358.424	114.952	361.021	115.108	363.621	115.271	366.226	115.442	368.835	115.621	371.449	115.807	374.067	116.000	376.689	116.202	379.315	116.410	360	100 (P)
350	339.561	111.282	342.141	111.411	344.726	111.547	347.316	111.692	349.910	111.845	352.509	112.005	355.112	112.173	357.719	112.349	360.332	112.532	362.948	112.724	365.569	112.923	368.193	113.130	370.825	113.344	350	
300	296.959	95.694	299.552	95.844	302.150	96.004	304.754	96.173	307.363	96.351	309.977	96.537	312.596	96.733	315.220	96.938	317.850	97.152	320.484	97.375	323.124	97.607	325.768	97.849	328.417	98.099	300	
250	254.396	80.173	257.006	80.354	259.623	80.545	262.246	80.747	264.875	80.960	267.510	81.184	270.151	81.419	272.798	81.665	275.450	81.921	278.109	82.189	280.774	82.467	283.444	82.756	286.120	83.055	250	
230	237.387	73.993	240.007	74.189	242.633	74.397	245.265	74.617	247.904	74.848	250.550	75.092	253.202	75.347	255.860	75.614	258.525	75.892	261.196	76.183	263.873	76.485	266.556	76.798	269.245	77.124	230	80 (P)*
200	211.900	64.768	214.536	64.994	217.179	65.232	219.829	65.485	222.487	65.751	225.152	66.031	227.825	66.323	230.504	66.630	233.190	66.950	235.884	67.283	238.583	67.630	241.290	67.990	244.003	68.364	200	
170	186.457	55.624	189.114	55.888	191.780	56.169	194.454	56.466	197.137	56.778	199.827	57.106	202.526	57.450	205.232	57.810	207.946	58.186	210.668	58.577	213.397	58.984	216.134	59.406	218.878	59.844	170	
155	173.760	51.096	176.430	51.386	179.110	51.693	181.799	52.018	184.497	52.360	187.203	52.720	189.918	53.097	192.641	53.491	195.372	53.902	198.112	54.330	200.859	54.775	203.614	55.238	206.376	55.717	155	65 (P)*
125	148.439	42.181	151.145	42.540	153.862	42.920	156.588	43.322	159.325	43.744	162.072	44.188	164.828	44.653	167.594	45.140	170.368	45.647	173.152	46.174	175.944	46.723	178.744	47.292	181.552	47.882	125	
100	127.460	34.996	130.208	35.442	132.968	35.915	135.739	36.414	138.521	36.940	141.314	37.491	144.118	38.068	146.931	38.670	149.754	39.298	152.586	39.952	155.427	40.631	158.277	41.334	161.134	42.063	100	
90	119.118	32.227	121.887	32.722	124.669	33.246	127.463	33.798	130.268	34.379	133.084	34.989	135.911	35.627	138.747	36.293	141.594	36.987	144.449	37.709	147.313	38.458	150.184	39.234	153.064	40.036	90	50 (P)
80	110.817	29.552	113.611	30.106	116.419	30.693	119.238	31.311	122.069	31.962	124.911	32.643	127.764	33.356	130.626	34.100	133.497	34.874	136.377	35.679	139.265	36.513	142.160	37.377	145.062	38.271	80	50 (H)**
70	102.570	27.008	105.394	27.638	108.230	28.304	111.079	29.006	113.9[illegible]	29.743	116.810	30.515	119.691	31.322	122.580	32.163	125.477	33.037	128.382	33.945	131.293	34.885	134.210	35.858	137.132	36.862	70	
60	94.396	24.658	97.253	25.386	100.123	26.156	103.004	26.965	105.896	27.815	108.796	28.703	111.705	29.630	114.620	30.594	117.542	31.596	120.467	32.634	123.397	33.708	126.329	34.817	129.262	35.960	60	40 (P)*
55	90.343	23.587	93.219	24.376	96.106	25.209	99.004	26.085	101.911	27.004	104.825	27.963	107.746	28.963	110.673	30.003	113.602	31.082	116.535	32.198	119.468	33.351	122.401	34.541	125.333	35.765	55	
50	86.318	22.610	89.212	23.471	92.117	24.379	95.031	25.332	97.951	26.330	100.878	27.372	103.808	28.456	106.741	29.582	109.674	30.748	112.607	31.953	115.537	33.196	118.464	34.476	121.385	35.791	50	40 (H)**
45	82.324	21.756	85.236	22.702	88.156	23.697	91.083	24.741	94.014	25.833	96.947	26.970	99.880	28.151	102.812	29.375	105.740	30.641	108.662	31.947	111.578	33.290	114.484	34.670	117.379	36.085	45	35 (P)*
40	78.361	21.064	81.288	22.111	84.219	23.211	87.153	24.362	90.085	25.563	93.015	26.810	95.940	28.104	98.857	29.440	101.763	30.818	104.658	32.235							40	30 (H)**
35	74.425	20.593	77.359	21.762	80.290	22.986	83.217	24.263	86.136	25.591	89.043	26.966															35	
33	72.854	20.484	75.786	21.709	78.712	22.989	81.630	24.322	84.535	25.705																	33	30 (P)*
30	70.493	20.427	73.414	21.742	76.323	23.114																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 82 Degrees

$\Delta = 82°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2180.717	812.535	2183.219	812.539	2185.723	812.544	2188.227	812.550	2190.731	812.558	2193.237	812.566	2195.743	812.575	2198.250	812.586	2200.758	812.597	2203.266	812.610	2205.775	812.624	2208.284	812.639	2210.795	812.655	2500	
2200	1919.932	715.032	1922.435	715.037	1924.938	715.042	1927.443	715.050	1929.948	715.058	1932.454	715.067	1934.961	715.078	1937.469	715.090	1939.978	715.103	1942.487	715.117	1944.997	715.133	1947.509	715.150	1950.020	715.168	2200	
2000	1746.075	650.031	1748.578	650.035	1751.082	650.042	1753.587	650.049	1756.093	650.058	1758.600	650.069	1761.108	650.080	1763.616	650.093	1766.125	650.108	1768.636	650.124	1771.147	650.141	1773.659	650.160	1776.172	650.180	2000	
1800	1572.218	585.029	1574.722	585.034	1577.226	585.041	1579.732	585.050	1582.239	585.060	1584.746	585.071	1587.255	585.084	1589.764	585.099	1592.274	585.115	1594.786	585.132	1597.299	585.152	1599.812	585.172	1602.326	585.194	1800	
1500	1311.434	487.527	1313.938	487.533	1316.443	487.541	1318.950	487.551	1321.458	487.563	1323.967	487.577	1326.477	487.593	1328.988	487.610	1331.501	487.630	1334.015	487.651	1336.530	487.674	1339.046	487.699	1341.563	487.725	1500	
1200	1050.649	390.025	1053.155	390.033	1055.661	390.043	1058.170	390.056	1060.679	390.071	1063.191	390.088	1065.703	390.108	1068.218	390.130	1070.733	390.154	1073.250	390.180	1075.769	390.209	1078.290	390.240	1080.811	390.273	1200	
1000	876.793	325.024	879.300	325.034	881.808	325.047	884.318	325.062	886.830	325.080	889.343	325.101	891.858	325.124	894.375	325.150	896.894	325.179	899.415	325.211	901.937	325.245	904.461	325.283	906.988	325.323	1000	
900	789.866	292.523	792.373	292.536	794.882	292.550	797.393	292.566	799.906	292.586	802.421	292.609	804.938	292.635	807.457	292.664	809.978	292.697	812.501	292.732	815.025	292.770	817.552	292.812	820.081	292.856	900	
800	702.938	260.025	705.446	260.037	707.957	260.033	710.469	260.072	712.983	260.094	715.500	260.120	718.020	260.149	720.541	260.182	723.064	260.219	725.590	260.258	728.118	260.301	730.648	260.348	733.180	260.398	800	100 (P)*
700	616.011	227.526	618.521	227.540	621.032	227.558	623.546	227.579	626.063	227.603	628.582	227.630	631.104	227.658	633.628	227.706	636.155	227.747	638.685	227.792	641.216	227.842	643.750	227.895	646.287	227.952	700	
600	529.085	195.028	531.595	195.044	534.109	195.065	536.625	195.090	539.145	195.120	541.667	195.155	544.193	195.194	546.721	195.237	549.252	195.286	551.786	195.339	554.323	195.396	556.863	195.458	559.406	195.525	600	
500	442.159	162.531	444.672	162.551	447.188	162.575	449.708	162.605	452.231	162.641	454.758	162.683	457.288	162.730	459.822	162.782	462.359	162.840	464.900	162.904	467.444	162.973	469.992	163.047	472.543	163.127	500	
400	355.233	130.036	357.750	130.060	360.270	130.091	362.795	130.129	365.324	130.174	367.857	130.226	370.395	130.284	372.937	130.350	375.484	130.427	378.035	130.502	380.590	130.588	383.149	130.681	385.712	130.781	400	
360	320.466	117.039	322.983	117.066	325.505	117.100	328.032	117.143	330.565	117.192	333.102	117.250	335.644	117.315	338.190	117.388	340.742	117.468	343.298	117.556	345.859	117.652	348.425	117.756	350.995	117.867	360	
350	311.773	113.790	314.291	113.817	316.814	113.853	319.342	113.896	321.875	113.948	324.413	114.007	326.956	114.073	329.504	114.149	332.057	114.231	334.613	114.322	337.178	114.421	339.745	114.527	342.317	114.641	350	
300	268.312	97.545	270.833	97.577	273.360	97.619	275.893	97.669	278.432	97.729	280.976	97.798	283.526	97.876	286.082	97.964	288.643	98.060	291.210	98.166	293.783	98.281	296.361	98.405	298.945	98.538	300	80 (P)*
250	224.854	81.303	227.379	81.341	229.911	81.391	232.450	81.452	234.996	81.523	237.549	81.606	240.109	81.700	242.675	81.805	245.248	81.921	247.828	82.048	250.415	82.186	253.008	82.334	255.608	82.494	250	
230	207.471	74.807	209.998	74.849	212.533	74.903	215.075	74.969	217.625	75.047	220.183	75.137	222.747	75.239	225.319	75.353	227.899	75.479	230.485	75.616	233.079	75.766	235.680	75.928	238.287	76.103	230	
200	181.397	65.064	183.929	65.113	186.469	65.175	189.017	65.251	191.574	65.341	194.140	65.444	196.714	65.561	199.297	65.692	201.887	65.837	204.486	65.995	207.093	66.168	209.708	66.354	212.331	66.553	200	
170	155.326	55.323	157.863	55.382	160.409	55.455	162.966	55.544	165.533	55.650	168.110	55.771	170.697	55.909	173.293	56.063	175.898	56.234	178.514	56.420	181.138	56.622	183.772	56.841	186.414	57.076	170	65 (P)*
150	142.291	50.457	144.831	50.519	147.383	50.599	149.945	50.697	152.518	50.813	155.102	50.946	157.696	51.098	160.301	51.267	162.917	51.453	165.542	51.657	168.177	51.879	170.823	52.119	173.478	52.376	150	
125	116.225	40.726	118.774	40.803	121.338	40.902	123.914	41.034	126.504	41.167	129.107	41.330	131.723	41.520	134.351	41.739	136.991	41.960	139.644	42.213	142.309	42.488	144.985	42.783	147.673	43.103	125	
100	94.509	32.625	97.070	32.722	99.648	32.846	102.243	32.998	104.854	33.177	107.481	33.383	110.123	33.617	112.780	33.878	115.452	34.167	118.139	34.482	120.839	34.825	123.553	35.195	126.281	35.591	100	
90	85.824	29.389	88.392	29.496	90.979	29.634	93.584	29.803	96.206	30.002	98.846	30.231	101.502	30.491	104.175	30.780	106.864	31.101	109.568	31.451	112.287	31.831	115.021	32.241	117.770	32.680	90	50 (P)*
80	77.142	26.156	79.719	26.277	82.315	26.432	84.932	26.621	87.569	26.845	90.224	27.103	92.898	27.395	95.590	27.720	98.299	28.080	101.025	28.473	103.766	28.900	106.524	29.359	109.297	29.853	80	50 (H)**
70	68.464	22.928	71.050	23.066	73.660	23.243	76.292	23.460	78.946	23.715	81.621	24.009	84.317	24.342	87.032	24.714	89.766	25.124	92.518	25.572	95.287	26.058	98.073	26.581	100.875	27.142	70	
60	59.789	19.708	62.389	19.868	65.016	20.075	67.668	20.327	70.345	20.624	73.045	20.967	75.768	21.355	78.513	21.787	81.278	22.263	84.063	22.784	86.866	23.348	89.686	23.955	92.523	24.605	60	40 (P)*
55	55.454	18.101	58.063	18.277	60.700	18.502	63.365	18.777	66.056	19.101	68.772	19.474	71.511	19.896	74.274	20.367	77.058	20.885	79.861	21.451	82.684	22.064	85.524	22.724	88.380	23.429	55	
50	51.122	16.499	53.740	16.692	56.390	16.939	59.069	17.241	61.777	17.597	64.511	18.007	67.270	18.470	70.052	18.987	72.857	19.555	75.682	20.175	78.527	20.846	81.388	21.567	84.266	22.338	50	40 (H)**
45	46.792	14.901	49.423	15.115	52.087	15.390	54.784	15.725	57.511	16.120	60.266	16.575	63.047	17.088	65.853	17.659	68.682	18.288	71.531	18.973	74.399	19.714	77.284	20.508	80.185	21.354	45	35 (P)*
40	42.466	13.311	45.112	13.551	47.795	13.860	50.512	14.236	53.262	14.680	56.042	15.189	58.849	15.764	61.682	16.403	64.537	17.106	67.413	17.871	70.306	18.696	73.215	19.582	76.136	20.525	40	35 (H) 30 (P)*
35	38.146	11.730	40.811	12.003	43.516	12.357	46.259	12.786	49.037	13.291	51.846	13.870	54.684	14.523	57.546	15.248	60.431	16.043	63.334	16.907	66.253	17.838	69.184	18.834	72.123	19.893	35	
33	36.420	11.101	39.093	11.392	41.809	11.766	44.564	12.220	47.355	12.754	50.177	13.367	53.028	14.058	55.904	14.823	58.801	15.663	61.715	16.574	64.643	17.554	67.581	18.601	70.526	19.714	33	
30	33.834	10.163	36.523	10.484	39.257	10.893	42.031	11.392	44.843	11.978	47.687	12.649	50.560	13.403	53.455	14.239	56.371	15.153	59.300	16.144	62.240	17.203	65.186	18.342	68.133	19.543	30	30 (H)**
25	29.535	8.621	32.255	9.004	35.026	9.493	37.841	10.087	40.694	10.784	43.579	11.579	46.489	12.470	49.417	13.453	52.358	14.524	55.304	15.679	58.260	16.912	61.188	18.219	64.114	19.595	25	
23	27.820	8.013	30.557	8.429	33.345	8.960	36.179	9.603	39.051	10.356	41.953	11.214	44.877	12.173	47.816	13.229	50.762	14.377	53.707	15.610	56.645	16.924	59.568	18.311			23	25 (P)*
20	25.256	7.118	28.021	7.595	30.841	8.202	33.706	8.935	36.607	9.791	39.534	10.763	42.475	11.844	45.422	13.029	48.364	14.309	51.291	15.676							20	25 (H)**
15	21.016	5.696	23.844	6.324	26.721	7.119	29.650	8.072	32.593	9.171	35.538	10.404	38.468	11.757													15	20 (P)*
14	20.175	5.428	23.019	6.099	25.917	6.946	28.849	7.957	31.795	9.120	34.754	10.419															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 82 Degrees

$\Delta = 82°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2213.306	812.672	2215.818	812.690	2218.331	812.709	2220.844	812.730	2223.358	812.751	2225.873	812.774	2228.388	812.798	2230.904	812.823	2233.421	812.848	2235.939	812.876	2238.457	812.904	2240.976	812.933	2243.496	812.963	2500	
2100	1952.533	715.187	1955.046	715.208	1957.561	715.230	1960.076	715.253	1962.592	715.278	1965.108	715.303	1967.626	715.331	1970.145	715.359	1972.664	715.388	1975.184	715.419	1977.704	715.451	1980.226	715.484	1982.748	715.519	2100	
2000	1778.686	650.201	1781.201	650.224	1783.717	650.248	1786.233	650.273	1788.751	650.300	1791.270	650.329	1793.789	650.359	1796.309	650.389	1798.830	650.422	1801.352	650.456	1803.875	650.491	1806.398	650.527	1808.923	650.563	2000	
1800	1604.842	585.218	1607.358	585.244	1609.876	585.271	1612.395	585.299	1614.914	585.329	1617.434	585.360	1619.956	585.393	1622.478	585.428	1625.001	585.464	1627.526	585.501	1630.051	585.540	1632.577	585.581	1635.105	585.623	1800	
1500	1344.082	487.754	1346.601	487.784	1349.123	487.817	1351.645	487.851	1354.168	487.886	1356.692	487.924	1359.218	487.964	1361.745	488.005	1364.273	488.048	1366.802	488.094	1369.332	488.140	1371.864	488.189	1374.396	488.240	1500	
1200	1083.334	390.309	1085.859	390.347	1088.385	390.387	1090.912	390.430	1093.441	390.475	1095.972	390.522	1098.504	390.571	1101.037	390.623	1103.572	390.677	1106.108	390.733	1108.646	390.792	1111.186	390.853	1113.726	390.916	1200	
1000	909.515	325.365	912.045	325.411	914.576	325.459	917.109	325.510	919.644	325.564	922.180	325.621	924.718	325.680	927.258	325.742	929.800	325.807	932.343	325.875	934.888	325.945	937.435	326.018	939.984	326.094	1000	
900	822.612	292.904	825.145	292.954	827.679	293.008	830.216	293.064	832.754	293.124	835.295	293.187	837.837	293.253	840.381	293.322	842.927	293.394	845.476	293.469	848.026	293.547	850.577	293.629	853.131	293.713	900	
800	735.715	260.451	738.231	260.508	740.791	260.569	743.331	260.633	745.875	260.700	748.420	260.771	750.968	260.845	753.517	260.922	756.069	261.003	758.623	261.088	761.179	261.176	763.737	261.267	766.298	261.362	800	
700	648.826	228.013	651.368	228.078	653.913	228.147	656.459	228.220	659.009	228.297	661.560	228.378	664.115	228.462	666.671	228.552	669.230	228.644	671.792	228.740	674.355	228.841	676.922	228.946	679.490	229.054	700	
600	561.952	195.596	564.500	195.672	567.052	195.753	569.606	195.838	572.163	195.927	574.723	196.021	577.286	196.120	579.852	196.224	582.420	196.332	584.991	196.445	587.566	196.562	590.143	196.684	592.722	196.810	600	
500	473.098	163.213	477.656	163.303	480.217	163.400	482.782	163.502	485.350	163.610	487.922	163.723	490.497	163.842	493.075	163.966	495.656	164.095	498.241	164.230	500.830	164.371	503.421	164.517	506.016	164.669	500	
400	388.280	130.888	390.852	131.001	393.428	131.122	396.009	131.250	398.593	131.384	401.182	131.526	403.774	131.674	406.371	131.829	408.972	131.991	411.577	132.160	414.186	132.335	416.799	132.518	419.416	132.707	400	
360	353.570	117.986	356.149	118.112	358.734	118.246	361.323	118.388	363.916	118.537	366.514	118.694	369.116	118.859	371.723	119.031	374.333	119.211	376.950	119.398	379.571	119.593	382.195	119.796	384.824	120.006	360	100 (P)*
330	344.895	114.763	347.476	114.893	350.063	115.031	352.654	115.177	355.250	115.331	357.851	115.492	360.456	115.661	363.065	115.839	365.680	116.023	368.299	116.216	370.922	116.417	373.550	116.625	376.182	116.842	330	
300	301.534	98.681	304.129	98.832	306.729	98.993	309.335	99.163	311.946	99.342	314.562	99.530	317.183	99.728	319.810	99.934	322.442	100.150	325.079	100.375	327.721	100.608	330.368	100.852	333.021	101.104	300	
250	258.214	82.665	260.826	82.847	263.445	83.040	266.070	83.243	268.701	83.458	271.339	83.684	273.983	83.921	276.633	84.168	279.288	84.427	281.950	84.696	284.618	84.976	287.291	85.267	289.970	85.569	250	
230	240.902	76.287	243.524	76.485	246.152	76.695	248.787	76.916	251.429	77.149	254.078	77.394	256.733	77.651	259.394	77.920	262.062	78.201	264.736	78.494	267.417	78.798	270.104	79.114	272.796	79.442	230	80 (P)*
200	214.961	66.767	217.600	66.934	220.246	67.234	222.899	67.489	225.560	67.757	228.228	68.038	230.904	68.333	233.587	68.642	236.277	68.965	238.974	69.301	241.678	69.650	244.389	70.013	247.106	70.389	200	
170	189.066	57.326	191.726	57.593	194.395	57.876	197.073	58.175	199.759	58.490	202.453	58.820	205.156	59.167	207.866	59.529	210.585	59.908	213.311	60.302	216.045	60.712	218.787	61.138	221.536	61.579	170	
155	176.143	52.651	178.817	52.943	181.500	53.253	184.193	53.581	186.894	53.926	189.605	54.288	192.324	54.667	195.052	55.064	197.788	55.479	200.532	55.910	203.285	56.359	206.045	56.825	208.813	57.308	155	65 (P)*
125	130.372	43.443	153.082	43.804	155.803	44.188	158.535	44.592	161.276	45.018	164.028	45.465	166.790	45.934	169.561	46.424	172.341	46.935	175.131	47.466	177.929	48.019	180.736	48.593	183.551	49.187	125	
100	129.021	36.014	131.774	36.464	134.539	39.941	137.316	37.444	140.105	37.973	142.904	38.528	145.714	39.110	148.535	39.717	151.365	40.350	154.205	41.008	157.053	41.692	159.911	42.401	162.777	43.135	100	
90	120.531	33.149	123.306	33.648	126.094	34.176	128.894	34.733	131.706	35.318	134.529	35.933	137.363	36.575	140.208	37.246	143.062	37.946	145.925	38.673	148.798	39.427	151.679	40.209	154.567	41.018	90	50 (P)
80	112.084	30.378	114.885	30.937	117.699	31.528	120.525	32.151	123.364	32.807	126.214	33.493	129.074	34.212	131.945	34.961	134.825	35.741	137.715	36.552	140.612	37.393	143.517	38.263	146.429	39.163	80	50 (H)*
70	103.492	27.740	106.523	28.375	109.567	29.046	112.221	29.753	115.093	30.496	117.972	31.274	120.862	32.086	123.761	32.934	126.669	33.815	129.584	34.729	132.506	35.677	135.434	36.657	138.367	37.669	70	
60	95.375	25.297	98.240	26.031	101.119	26.806	104.010	27.622	106.911	28.477	109.822	29.372	112.741	30.306	115.668	31.278	118.601	32.288	121.539	33.334	124.480	34.413	127.425	35.552	130.372	36.684	60	40 (P)*
55	91.252	24.180	94.137	24.975	97.034	25.815	99.941	26.697	102.859	27.623	105.785	28.589	108.717	29.597	111.655	30.645	114.598	31.731	117.543	32.856	120.490	34.018	123.437	35.217	126.383	36.450	55	
50	87.158	23.158	90.062	24.026	92.977	24.940	95.902	25.901	98.834	26.906	101.772	27.956	104.715	29.048	107.661	30.183	110.608	31.358	113.554	32.572	116.499	33.824	119.440	35.114	122.377	36.439	50	40 (H)**
45	83.096	22.260	86.019	23.213	88.951	24.216	91.889	25.268	94.833	26.367	97.779	27.513	100.726	28.703	103.672	29.937	106.614	31.212	109.552	32.527	112.443	33.881	115.405	35.272	118.316	36.697	45	35 (P)*
40	79.067	21.525	82.006	22.580	84.950	23.688	87.897	24.848	90.844	26.057	93.788	27.315	96.727	28.618	99.660	29.964	102.592	31.353	105.493	32.780							40	30 (H)**
35	75.068	21.013	78.015	22.190	80.961	23.424	83.902	24.711	86.836	26.048	89.759	27.433															35	
33	73.473	20.888	76.418	22.121	79.360	23.411	82.292	24.755	85.213	26.148																	33	30 (P)*
30	71.076	20.808	74.012	22.133	76.937	23.514																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 83 Degrees

△=83°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2219.313	837.984	2221.816	837.988	2224.319	837.993	2226.823	837.999	2229.328	838.007	2231.833	838.015	2234.340	838.024	2236.847	838.035	2239.354	838.047	2241.863	838.060	2244.372	838.073	2246.882	838.089	2249.392	838.104	2500	
2200	1953.896	737.427	1956.399	737.432	1958.903	737.437	1961.408	737.445	1963.913	737.453	1966.419	737.462	1968.927	737.473	1971.435	737.485	1973.943	737.498	1976.453	737.513	1978.963	737.529	1981.474	737.546	1983.987	737.564	2200	
2000	1776.952	670.390	1779.455	670.395	1781.959	670.401	1784.464	670.408	1786.970	670.418	1789.477	670.428	1791.985	670.440	1794.494	670.453	1797.003	670.468	1799.514	670.484	1802.026	670.501	1804.538	670.520	1807.051	670.540	2000	
1800	1600.008	603.352	1602.511	603.357	1605.016	603.364	1607.521	603.373	1610.028	603.383	1612.536	603.395	1615.044	603.408	1617.554	603.422	1620.065	603.439	1622.576	603.456	1625.089	603.476	1627.603	603.497	1630.118	603.519	1800	
1500	1334.592	502.796	1337.096	502.802	1339.601	502.811	1342.108	502.821	1344.616	502.833	1347.125	502.847	1349.635	502.863	1352.147	502.880	1354.660	502.900	1357.174	502.921	1359.689	502.944	1362.206	502.969	1364.723	502.996	1500	
1200	1069.176	402.240	1071.681	402.249	1074.188	402.259	1076.696	402.272	1079.206	402.287	1081.718	402.304	1084.231	402.324	1086.745	402.346	1089.261	402.370	1091.779	402.397	1094.298	402.426	1096.818	402.457	1099.340	402.491	1200	
1000	892.232	335.204	894.739	335.214	897.247	335.227	899.757	335.242	902.269	335.260	904.783	335.281	907.298	335.304	909.816	335.331	912.335	335.360	914.855	335.392	917.378	335.427	919.903	335.464	922.429	335.505	1000	
900	803.761	301.687	806.268	301.697	808.777	301.711	811.288	301.728	813.801	301.748	816.317	301.771	818.434	301.798	821.353	301.827	823.875	301.860	826.398	301.895	828.923	301.934	831.450	301.975	833.980	302.020	900	
800	715.290	268.169	717.797	268.181	720.308	268.197	722.820	268.216	725.335	268.239	727.852	268.265	730.372	268.294	732.894	268.327	735.417	268.364	737.944	268.404	740.472	268.447	743.003	268.494	745.536	268.544	800	
700	626.819	234.652	629.328	234.666	631.839	234.684	634.354	234.706	636.871	234.732	639.390	234.761	641.913	234.795	644.437	234.833	646.964	234.875	649.495	234.920	652.027	234.970	654.562	235.024	657.099	235.081	700	100 (P)*
600	538.348	201.136	540.859	201.152	543.373	201.173	545.889	201.198	548.409	201.229	550.932	201.263	553.458	201.303	555.986	201.347	558.518	201.395	561.053	201.449	563.591	201.507	566.132	201.569	568.675	201.636	600	
500	449.879	167.621	452.391	167.641	454.908	167.665	457.428	167.696	459.951	167.732	462.479	167.774	465.010	167.821	467.544	167.874	470.082	167.932	472.624	167.997	475.169	168.066	477.718	168.141	480.270	168.222	500	
400	361.410	134.108	363.926	134.132	366.447	134.164	368.972	134.202	371.501	134.247	374.035	134.299	376.574	134.358	379.117	134.425	381.664	134.497	384.216	134.577	386.772	134.664	389.332	134.758	391.897	134.859	400	
360	326.024	120.704	328.542	120.731	331.064	120.766	333.592	120.808	336.125	120.858	338.662	120.916	341.205	120.982	343.753	121.055	346.305	121.136	348.862	121.225	351.424	121.322	353.991	121.426	356.563	121.538	360	
350	317.177	117.353	319.695	117.381	322.219	117.417	324.747	117.460	327.281	117.512	329.820	117.571	332.363	117.639	334.913	117.714	337.466	117.798	340.025	117.889	342.589	117.989	345.157	118.095	347.731	118.211	350	
300	272.945	100.599	275.466	100.632	277.993	100.674	280.527	100.724	283.066	100.785	285.611	100.854	288.162	100.933	290.719	101.021	293.281	101.118	295.849	101.225	298.424	101.342	301.003	101.466	303.588	101.600	300	80 (P)*
250	228.714	83.848	231.239	83.887	233.772	83.937	236.312	83.998	238.859	84.071	241.413	84.154	243.973	84.249	246.541	84.354	249.116	84.471	251.697	84.599	254.285	84.738	256.880	84.888	259.482	85.049	250	
230	211.022	77.148	213.550	77.191	216.085	77.245	218.629	77.312	221.179	77.390	223.738	77.481	226.304	77.584	228.877	77.698	231.458	77.825	234.046	77.964	236.642	78.115	239.244	78.278	241.854	78.453	230	
200	184.486	67.101	187.018	67.130	189.558	67.212	192.108	67.289	194.666	67.379	197.233	67.483	199.808	67.601	202.392	67.733	204.985	67.879	207.585	68.039	210.194	68.212	212.811	68.400	215.436	68.601	200	
170	157.951	57.056	160.489	57.113	163.036	57.187	165.594	57.277	168.162	57.383	170.741	57.506	173.329	57.645	175.927	57.800	178.534	57.972	181.152	58.159	183.778	58.363	186.415	58.584	189.060	58.820	170	65 (P)*
155	144.685	52.035	147.226	52.098	149.778	52.179	152.341	52.278	154.916	52.394	157.501	52.529	160.098	52.681	162.705	52.581	165.322	53.039	167.950	53.245	170.588	53.469	173.236	53.710	175.894	53.969	155	
125	118.156	41.999	120.706	42.077	123.271	42.177	125.849	42.299	128.440	42.444	131.045	42.610	133.663	42.799	136.293	43.010	138.937	43.243	141.592	43.498	144.260	43.775	146.940	44.074	149.632	44.394	125	
100	96.054	33.644	98.616	33.742	101.196	33.867	103.793	34.019	106.406	34.200	109.035	34.408	111.680	34.644	114.340	34.907	117.015	35.198	119.705	35.516	122.410	35.861	125.128	36.233	127.860	36.633	100	
90	87.216	30.306	89.785	30.414	92.373	30.553	94.980	30.723	97.604	30.923	100.246	31.155	102.906	31.416	105.582	31.708	108.275	32.031	110.983	32.384	113.707	32.767	116.446	33.180	119.199	33.623	90	50 (P)*
80	78.379	26.972	80.957	27.093	83.555	27.250	86.175	27.440	88.814	27.666	91.472	27.926	94.149	28.220	96.845	28.548	99.558	28.910	102.288	29.306	105.035	29.736	107.798	30.200	110.577	30.696	80	50 (H)**
70	69.546	23.642	72.134	23.781	74.746	23.960	77.381	24.178	80.038	24.435	82.717	24.731	85.416	25.067	88.135	25.441	90.874	25.854	93.631	26.306	96.406	26.796	99.199	27.323	102.007	27.888	70	
60	60.718	20.320	63.320	20.482	65.949	20.690	68.604	20.944	71.284	21.244	73.989	21.589	76.716	21.980	79.466	22.415	82.237	22.895	85.027	23.420	87.837	23.988	90.664	24.600	93.509	25.255	60	40 (P)*
55	56.306	18.663	58.917	18.840	61.556	19.067	64.224	19.343	66.919	19.670	69.639	20.046	72.384	20.472	75.152	20.946	77.942	21.468	80.752	22.039	83.582	22.656	86.430	23.321	89.294	24.032	55	
50	51.896	17.010	54.517	17.204	57.170	17.453	59.853	17.758	62.564	18.117	65.303	18.530	68.067	18.997	70.856	19.517	73.668	20.089	76.500	20.714	79.352	21.390	82.222	22.117	85.109	22.894	50	40 (H)**
45	47.490	15.262	50.123	15.577	52.791	15.854	55.492	16.192	58.223	16.590	60.983	17.048	63.771	17.565	66.583	18.141	69.419	18.774	72.276	19.464	75.153	20.211	78.047	21.012	80.956	21.868	45	35 (P)*
40	43.087	13.720	45.736	13.963	48.422	14.274	51.144	14.653	53.899	15.100	56.685	15.613	59.499	16.192	62.339	16.837	65.203	17.545	68.087	18.315	70.990	19.147	73.909	20.039	76.841	20.990	40	35 (H) 30 (P)*
35	38.690	12.089	41.358	12.366	44.068	12.721	46.816	13.153	49.599	13.662	52.415	14.245	55.261	14.903	58.132	15.634	61.026	16.435	63.939	17.306	66.869	18.244	69.811	19.248	72.763	20.315	35	
33	36.934	11.440	39.611	11.733	42.331	12.110	45.091	12.567	47.888	13.106	50.718	13.724	53.577	14.419	56.461	15.191	59.368	16.036	62.293	16.954	65.232	17.942	68.183	18.998	71.140	20.119	33	
30	34.302	10.472	36.994	10.795	39.733	11.208	42.514	11.710	45.333	12.300	48.184	12.976	51.065	13.736	53.971	14.579	56.897	15.500	59.838	16.498	62.790	17.570	65.749	18.713	68.710	19.924	30	30 (H)**
25	29.926	8.879	32.651	9.265	35.428	9.758	38.250	10.357	41.111	11.059	44.005	11.860	46.925	12.758	49.865	13.749	52.818	14.828	55.778	15.991	58.738	17.234	61.692	18.551	64.634	19.938	25	
23	28.181	8.252	30.923	8.670	33.718	9.205	36.559	9.854	39.440	10.612	42.351	11.477	45.287	12.443	48.238	13.508	51.197	14.664	54.157	15.907	57.110	17.230	60.049	18.628			23	25 (P)*
20	25.572	7.327	28.342	7.807	31.170	8.418	34.044	9.158	36.954	10.020	39.892	10.999	42.846	12.089	45.807	13.282	48.761	14.572	51.707	15.950							20	25 (H)**
15	21.257	5.855	24.092	6.488	26.985	7.289	29.919	8.249	32.875	9.357	35.834	10.599	38.780	11.963													15	20 (P)*
14	20.401	5.578	23.257	6.254	26.161	7.107	29.105	8.126	32.065	9.298	35.019	10.607															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 83 Degrees

△=83°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2251.904	838.122	2254.416	838.140	2256.929	838.160	2259.442	838.180	2261.957	838.202	2264.472	838.225	2266.987	838.249	2269.504	838.274	2272.021	838.300	2274.539	838.327	2277.058	838.355	2279.577	838.385	2282.097	838.416	2500	
2200	1986.499	737.583	1989.013	737.604	1991.528	737.626	1994.043	737.650	1996.560	737.675	1999.076	737.700	2001.594	737.728	2004.113	737.756	2006.632	737.786	2009.153	737.817	2011.674	737.849	2014.196	737.883	2016.719	737.917	2200	
2000	1809.565	670.562	1812.080	670.584	1814.596	670.609	1817.113	670.635	1819.631	670.662	1822.150	670.690	1824.669	670.720	1827.190	670.751	1829.712	670.784	1832.234	670.818	1834.757	670.854	1837.281	670.890	1839.806	670.928	2000	
1800	1632.633	603.543	1635.150	603.568	1637.668	603.595	1640.187	603.624	1642.707	603.654	1645.227	603.686	1647.749	603.719	1650.272	603.754	1652.796	603.790	1655.321	603.828	1657.846	603.867	1660.373	603.908	1662.901	603.951	1800	
1500	1367.242	503.025	1369.762	503.055	1372.284	503.088	1374.806	503.122	1377.330	503.158	1379.854	503.196	1382.381	503.237	1384.908	503.278	1387.437	503.322	1389.966	503.367	1392.497	503.415	1395.029	503.463	1397.562	503.514	1500	
1200	1101.864	402.527	1104.389	402.565	1106.915	402.606	1109.443	402.648	1111.973	402.694	1114.504	402.741	1117.037	402.791	1119.571	402.843	1122.106	402.898	1124.643	402.954	1127.181	403.013	1129.721	403.075	1132.263	403.139	1200	
1000	924.958	335.548	927.488	335.594	930.020	335.642	932.553	335.694	935.088	335.748	937.625	335.805	940.164	335.865	942.705	335.927	945.248	335.993	947.792	336.061	950.338	336.132	952.885	336.206	955.435	336.282	1000	
900	836.511	302.068	839.044	302.119	841.580	302.173	844.117	302.230	846.656	302.291	849.197	302.354	851.740	302.420	854.285	302.490	856.832	302.563	859.381	302.638	861.932	302.717	864.485	302.799	867.040	302.884	900	
800	748.071	268.598	750.608	268.656	753.148	268.717	755.689	268.781	758.233	268.849	760.780	268.920	763.328	268.995	765.878	269.073	768.431	269.155	770.986	269.240	773.543	269.328	776.103	269.420	778.664	269.516	800	
700	659.639	235.143	662.182	235.208	664.727	235.278	667.275	235.351	669.825	235.429	672.377	235.510	674.932	235.595	677.490	235.685	680.050	235.778	682.613	235.875	685.178	235.977	687.745	236.082	690.315	236.191	700	
600	571.232	201.708	573.771	201.785	576.323	201.866	578.879	201.952	581.437	202.042	583.998	202.137	586.562	202.237	589.129	202.341	591.699	202.450	594.271	202.563	596.847	202.681	599.425	202.804	602.006	202.931	600	
500	482.825	168.308	485.384	168.399	487.947	168.497	490.513	168.600	493.082	168.708	495.655	168.822	498.231	168.941	500.811	169.067	503.394	169.197	505.981	169.333	508.571	169.475	511.164	169.623	513.760	169.775	500	
400	394.466	134.967	397.039	135.081	399.616	135.203	402.199	135.331	404.784	135.467	407.375	135.609	409.969	135.758	412.568	135.915	415.171	136.078	417.778	136.248	420.388	136.425	423.003	136.609	425.623	136.800	400	
360	358.139	121.658	361.720	121.785	364.306	121.920	366.897	122.063	369.491	122.213	372.092	122.372	374.696	122.538	377.305	122.711	379.918	122.892	382.536	123.081	385.159	123.278	387.785	123.482	390.417	123.694	360	100 (P)*
350	350.310	118.334	352.893	118.465	355.481	118.604	358.074	118.751	360.672	118.906	363.274	119.068	365.882	119.239	368.493	119.417	371.110	119.604	373.731	119.798	376.356	120.000	378.987	120.210	381.622	120.428	350	
300	306.179	101.744	308.776	101.896	311.378	102.058	313.986	102.230	316.599	102.410	319.217	102.600	321.841	102.799	324.470	103.007	327.104	103.224	329.744	103.450	332.389	103.686	335.039	103.931	337.694	104.185	300	
250	262.090	85.221	264.704	85.404	267.325	85.598	269.953	85.804	272.587	86.020	275.227	86.248	277.874	86.486	280.526	86.735	283.185	86.996	285.850	87.267	288.521	87.550	291.198	87.843	293.880	88.147	250	
230	244.471	78.640	247.095	78.840	249.726	79.051	252.363	79.274	255.008	79.509	257.659	79.756	260.317	80.015	262.982	80.286	265.653	80.569	268.331	80.863	271.015	81.170	273.705	81.489	276.402	81.819	230	80 (P)*
200	218.069	68.816	220.710	69.045	223.359	69.287	226.016	69.544	228.680	69.814	231.352	70.098	234.031	70.395	236.717	70.706	239.411	71.031	242.112	71.370	244.820	71.722	247.535	72.087	250.257	72.467	200	
170	191.714	59.073	194.378	59.342	197.050	59.627	199.731	59.928	202.421	60.245	205.119	60.578	207.826	60.928	210.541	61.293	213.263	61.674	215.994	62.071	218.733	62.484	221.480	62.913	224.234	63.358	170	
155	178.562	54.246	181.240	54.541	183.927	54.853	186.623	55.183	189.329	55.531	192.043	55.896	194.767	56.278	197.499	56.678	200.240	57.096	202.990	57.530	205.747	57.983	208.513	58.452	211.287	58.939	155	65 (P)*
125	152.335	44.737	155.049	45.161	157.775	45.487	160.511	45.898	163.257	46.324	166.014	46.772	168.781	47.247	171.558	47.741	174.345	48.255	177.140	48.791	179.945	49.348	182.759	49.926	185.581	50.525	125	
100	130.606	37.059	133.364	37.313	136.135	37.993	138.918	38.500	141.712	39.033	144.518	39.593	147.335	40.179	150.163	40.790	153.000	41.428	155.848	42.092	158.704	42.781	161.570	43.495	164.445	44.234	100	
90	121.966	34.096	124.747	34.398	127.541	35.130	130.348	35.691	133.166	36.281	135.997	36.900	138.838	37.548	141.690	38.224	144.553	38.929	147.425	39.661	150.306	40.421	153.196	41.209	156.094	42.024	90	50 (P)
80	113.370	31.226	116.177	31.789	118.998	32.385	121.832	33.013	124.678	33.673	127.536	34.365	130.405	35.089	133.285	35.844	136.174	36.630	139.073	37.447	141.980	38.295	144.895	39.172	147.818	40.079	80	50 (H)**
70	104.831	28.491	107.669	29.131	110.521	29.807	113.386	30.519	116.264	31.268	119.152	32.052	122.052	32.871	124.960	33.724	127.878	34.612	130.804	35.534	133.737	36.489	136.677	37.476	139.622	38.496	70	
60	96.368	25.952	99.243	26.692	102.131	27.473	105.031	28.295	107.942	29.157	110.863	30.059	113.793	31.000	116.731	31.979	119.676	32.997	122.626	34.051	125.581	35.141	128.538	36.266	131.498	37.427	60	40 (P)*
55	92.174	24.788	95.068	25.590	97.975	26.436	100.893	27.325	103.822	28.257	106.759	29.231	109.703	30.247	112.653	31.303	115.608	32.398	118.567	33.531	121.527	34.702	124.488	35.910	127.448	37.153	55	
50	88.010	23.720	90.924	24.594	93.850	25.516	96.786	26.484	99.730	27.497	102.681	28.555	105.636	29.656	108.595	30.799	111.556	31.983	114.516	33.206	117.476	34.468	120.432	35.768	123.384	37.103	50	40 (H)**
45	83.879	22.776	86.813	23.737	89.757	24.747	92.708	25.807	95.664	26.915	98.624	28.070	101.585	29.269	104.545	30.512	107.502	31.797	110.455	33.123	113.402	34.487	116.340	35.888	119.268	37.325	45	35 (P)*
40	79.784	21.998	82.735	23.061	85.692	24.178	88.652	25.346	91.613	26.565	94.572	27.832	97.527	29.145	100.475	30.502	103.414	31.901	106.341	33.339							40	30 (H)**
35	75.721	21.343	78.681	22.630	81.641	23.873	84.598	25.169	87.547	26.517	90.487	27.913															35	
33	74.101	21.302	77.061	22.545	80.017	23.845	82.965	25.198	85.903	26.603																	33	30 (P)*
30	71.668	21.198	74.620	22.534	77.560	23.926																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 84 Degrees

$\Delta = 84°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Special Cases
metre	Y_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	2258.512	864.066	2261.014	864.090	2263.518	864.095	2266.022	864.101	2268.527	864.109	2271.032	864.117	2273.539	864.127	2276.046	864.137	2278.554	864.149	2281.062	864.162	2283.572	864.176	2286.082	864.191	2288.593	864.208	2500	
2200	1988.391	760.397	1990.894	760.402	1993.398	760.407	1995.903	760.415	1998.408	760.423	2000.915	760.432	2003.422	760.443	2005.930	760.455	2008.439	760.469	2010.948	760.483	2013.459	760.499	2015.971	760.516	2018.483	760.535	2200	
2000	1808.311	691.271	1810.814	691.276	1813.318	691.282	1815.824	691.290	1818.330	691.300	1820.837	691.310	1823.345	691.322	1825.854	691.335	1828.363	691.350	1830.874	691.366	1833.386	691.384	1835.898	691.402	1838.412	691.423	2000	
1800	1628.231	622.144	1630.734	622.151	1633.239	622.158	1635.745	622.167	1638.251	622.177	1640.760	622.188	1643.268	622.202	1645.778	622.217	1648.289	622.233	1650.801	622.251	1653.314	622.270	1655.828	622.291	1658.343	622.314	1800	
1500	1358.111	518.457	1360.615	518.464	1363.121	518.472	1365.627	518.482	1368.136	518.494	1370.645	518.509	1373.155	518.524	1375.667	518.542	1378.180	518.562	1380.695	518.583	1383.210	518.607	1385.727	518.632	1388.245	518.659	1500	
1200	1087.991	414.770	1090.497	414.778	1093.004	414.788	1095.512	414.801	1098.022	414.816	1100.534	414.834	1103.047	414.854	1105.562	414.876	1108.078	414.900	1110.596	414.927	1113.115	414.957	1115.636	414.988	1118.159	415.022	1200	
1000	907.912	345.645	910.418	345.655	912.927	345.668	915.437	345.683	917.949	345.701	920.463	345.722	922.979	345.746	925.497	345.773	928.016	345.802	930.537	345.834	933.061	345.869	935.586	345.907	938.113	345.948	1000	
900	817.873	311.083	820.380	311.094	822.889	311.108	825.400	311.125	827.914	311.146	830.429	311.169	832.947	311.195	835.467	311.225	837.989	311.258	840.512	311.294	843.038	311.333	845.565	311.375	848.095	311.420	900	
800	727.833	276.522	730.341	276.534	732.852	276.550	735.365	276.569	737.880	276.592	740.397	276.618	742.917	276.648	745.439	276.681	747.964	276.718	750.490	276.758	753.019	276.802	755.550	276.849	758.084	276.900	800	
700	637.794	241.961	640.304	241.975	642.815	241.993	645.330	242.015	647.848	242.041	650.368	242.071	652.890	242.105	655.415	242.143	657.943	242.185	660.474	242.231	663.006	242.281	665.542	242.335	668.080	242.393	700	
600	547.756	207.401	550.267	207.417	552.781	207.438	555.298	207.464	557.818	207.494	560.341	207.529	562.868	207.569	565.397	207.613	567.929	207.662	570.465	207.716	573.003	207.774	575.545	207.837	578.089	207.905	600	
500	457.719	172.842	460.231	172.861	462.748	172.886	465.269	172.917	467.793	172.954	470.321	172.996	472.852	173.043	475.387	173.096	477.926	173.155	480.468	173.220	483.014	173.290	485.564	173.365	488.117	173.447	500	
400	367.682	138.285	370.199	138.309	372.719	138.341	375.245	138.379	377.775	138.425	380.310	138.477	382.849	138.537	385.393	138.604	387.940	138.677	390.493	138.758	393.050	138.845	395.612	138.940	398.178	139.041	400	
360	331.669	124.463	334.187	124.490	336.710	124.525	339.238	124.568	341.771	124.619	344.310	124.677	346.853	124.743	349.402	124.817	351.955	124.899	354.513	124.988	357.076	125.085	359.645	125.190	362.218	125.303	360	
320	322.663	121.008	325.184	121.035	327.708	121.072	330.237	121.116	332.771	121.167	335.311	121.228	337.855	121.295	340.405	121.372	342.960	121.456	345.520	121.548	348.085	121.648	350.654	121.756	353.229	121.872	320	
300	277.649	103.732	280.171	103.765	282.698	103.807	285.232	103.858	287.772	103.919	290.318	103.989	292.870	104.068	295.428	104.157	297.991	104.255	300.561	104.362	303.136	104.479	305.718	104.605	308.304	104.740	300	80 (P)*
250	232.634	86.458	235.160	86.498	237.694	86.548	240.234	86.610	242.782	86.683	245.337	86.767	247.899	86.862	250.468	86.969	253.044	87.086	255.626	87.215	258.216	87.355	260.813	87.506	263.416	87.669	250	
230	214.629	79.590	217.157	79.593	219.693	79.648	222.237	79.715	224.789	79.794	227.349	79.885	229.916	79.989	232.491	80.105	235.073	80.232	237.663	80.373	240.260	80.525	242.864	80.689	245.478	80.865	230	
200	187.623	69.190	190.153	69.239	192.696	69.302	195.247	69.379	197.806	69.470	200.374	69.575	202.951	69.694	205.536	69.827	208.130	69.974	210.733	70.135	213.344	70.310	215.963	70.499	218.591	70.701	200	
170	160.618	58.832	163.156	58.889	165.704	58.964	168.263	59.054	170.833	59.161	173.412	59.285	176.002	59.425	178.602	59.581	181.212	59.754	183.831	59.944	186.460	60.149	189.099	60.371	191.747	60.609	170	64 (P)*
155	147.116	53.654	149.658	53.718	152.211	53.799	154.776	53.898	157.351	54.016	159.938	54.151	162.536	54.305	165.143	54.477	167.765	54.666	170.395	54.874	173.036	55.099	175.687	55.342	178.348	55.604	155	
125	120.117	43.305	122.668	43.383	125.234	43.484	127.813	43.608	130.406	43.755	133.013	43.921	135.633	44.111	138.266	44.324	140.912	44.559	143.571	44.816	146.242	45.095	148.926	45.396	151.621	45.719	125	
100	97.623	34.689	100.187	34.787	102.768	34.913	105.366	35.067	107.982	35.249	110.613	35.459	113.261	35.697	115.924	35.965	118.603	36.255	121.297	36.575	124.005	36.923	126.728	37.299	129.465	37.701	100	
90	88.628	31.247	91.199	31.356	93.789	31.496	96.397	31.667	99.024	31.869	101.669	32.102	104.332	32.366	107.011	32.660	109.708	32.985	112.420	33.341	115.149	33.727	117.892	34.143	120.651	34.590	90	30 (P)*
80	79.636	27.808	82.213	27.931	84.815	28.088	87.436	28.281	90.078	28.508	92.739	28.769	95.420	29.065	98.119	29.397	100.837	29.762	103.572	30.161	106.324	30.594	109.092	31.061	111.877	31.563	80	30 (H)**
70	70.646	24.374	73.226	24.514	75.850	24.694	78.487	24.914	81.147	25.173	83.829	25.472	86.532	25.810	89.256	26.188	92.000	26.604	94.762	27.059	97.543	27.555	100.341	28.094	103.158	28.674	70	
60	61.661	20.948	64.265	21.111	66.896	21.321	69.555	21.577	72.238	21.879	74.947	22.227	77.679	22.621	80.434	23.060	83.210	23.544	86.007	24.072	88.823	24.645	91.658	25.262	94.510	25.922	60	
55	57.171	19.239	59.784	19.417	62.426	19.646	65.097	19.925	67.796	20.254	70.521	20.633	73.270	21.062	76.044	21.540	78.840	22.066	81.657	22.641	84.494	23.264	87.349	23.933	90.222	24.650	55	
50	52.683	17.534	55.307	17.730	57.962	17.981	60.648	18.288	63.364	18.649	66.108	19.066	68.878	19.536	71.672	20.060	74.491	20.637	77.330	21.267	80.191	21.949	83.069	22.681	85.965	23.464	50	40 (H)**
45	48.199	15.834	50.835	16.031	53.506	16.330	56.210	16.670	58.946	17.072	61.712	17.533	64.505	18.054	67.325	18.634	70.169	19.277	73.033	19.980	75.918	20.721	78.821	21.520	81.742	22.391	45	35 (H)**
40	43.718	14.140	46.370	14.385	49.060	14.698	51.786	15.081	54.545	15.531	57.338	16.048	60.159	16.632	63.006	17.281	65.879	17.995	68.772	18.771	71.685	19.610	74.614	20.509	77.557	21.467	40	33 (H) 20 (P)*
35	39.243	12.437	41.914	12.736	44.628	13.094	47.381	13.529	50.171	14.042	52.994	14.631	55.847	15.294	58.736	16.030	61.650	16.838	64.595	17.715	67.564	18.661	70.558	19.678	73.575	20.767	35	
33	37.456	11.787	40.136	12.083	42.861	12.462	45.626	12.924	48.429	13.466	51.266	14.089	54.133	14.790	57.027	15.567	59.944	16.420	62.880	17.345	65.831	18.341	68.793	19.405	71.764	20.534	33	
30	34.777	10.789	37.473	11.114	40.217	11.550	43.003	12.036	45.829	12.631	48.689	13.312	51.579	14.078	54.494	14.927	57.431	15.856	60.384	16.862	63.349	17.942	66.321	19.094	69.296	20.314	30	30 (H)**
25	30.354	9.174	33.054	9.533	35.836	10.030	38.665	10.634	41.535	11.341	44.438	12.146	47.369	13.053	50.330	14.052	53.316	15.136	56.329	16.312	59.364	17.564	62.420	18.892	65.494	20.288	25	
23	28.548	8.496	31.295	8.918	34.096	9.457	36.945	10.110	39.834	10.875	42.756	11.746	45.703	12.721	48.666	13.793	51.639	14.958	54.614	16.211	57.583	17.545	60.538	18.954			23	23 (P)*
20	25.893	7.540	28.669	8.024	31.503	8.641	34.386	9.386	37.307	10.254	40.256	11.241	43.223	12.340	46.197	13.543	49.169	14.843	52.129	16.231							20	25 (H)**
15	21.502	6.018	24.344	6.656	27.247	7.464	30.192	8.431	33.161	9.547	36.135	10.799	39.097	12.174													15	20 (P)*
14	20.031	5.731	23.491	6.412	26.409	7.272	29.365	8.299	32.338	9.480	35.308	10.799															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 84 Degrees

$\Delta = 84°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	2291.104	864.225	2293.616	864.243	2296.130	864.263	2298.643	864.284	2301.158	864.306	2303.673	864.329	2306.189	864.353	2308.706	864.378	2311.223	864.404	2313.742	864.432	2316.261	864.460	2318.780	864.490	2321.301	864.521	2500	
2200	2020.946	760.554	2023.510	760.576	2026.025	760.598	2028.541	760.622	2031.057	760.646	2033.574	760.673	2036.093	760.700	2038.612	760.729	2041.132	760.759	2043.652	760.790	2046.174	760.822	2048.696	760.856	2051.219	760.891	2200	
2000	1840.926	691.445	1843.442	691.468	1845.958	691.492	1848.475	691.518	1850.993	691.545	1853.512	691.574	1856.032	691.604	1858.553	691.636	1861.075	691.669	1863.598	691.703	1866.122	691.739	1868.646	691.776	1871.171	691.814	2000	
1800	1660.859	622.338	1663.376	622.364	1665.894	622.391	1668.413	622.420	1670.933	622.450	1673.454	622.482	1675.977	622.515	1678.500	622.551	1681.024	622.587	1683.549	622.625	1686.075	622.665	1688.603	622.706	1691.131	622.749	1800	
1600	1390.764	518.688	1393.285	518.719	1395.807	518.752	1398.329	518.786	1400.853	518.823	1403.378	518.861	1405.905	518.901	1408.433	518.943	1410.962	518.987	1413.492	519.033	1416.024	519.081	1418.556	519.130	1421.090	519.181	1600	
1400	1120.683	415.038	1123.208	415.097	1125.735	415.137	1128.264	415.181	1130.794	415.226	1133.325	415.274	1135.858	415.324	1138.393	415.377	1140.929	415.432	1143.467	415.489	1146.006	415.549	1148.547	415.611	1151.089	415.675	1400	
1200	940.641	345.991	943.172	346.038	945.704	346.087	948.238	346.138	950.774	346.193	953.312	346.250	955.852	346.311	958.393	346.374	960.937	346.440	963.481	346.508	966.028	346.580	968.577	346.654	971.127	346.731	1200	
1000	850.627	311.468	853.161	311.519	855.697	311.574	858.235	311.631	860.775	311.692	863.317	311.756	865.861	311.823	868.406	311.893	870.954	311.966	873.504	312.042	876.056	312.122	878.610	312.204	881.166	312.290	1000	
900	769.619	276.935	763.157	277.012	765.698	277.074	768.240	277.138	770.785	277.207	773.332	277.279	775.882	277.354	778.433	277.433	780.987	277.515	783.543	277.601	786.101	277.691	788.661	277.783	791.224	277.879	900	
800	670.621	242.455	673.164	242.521	675.710	242.592	678.259	242.666	680.810	242.744	683.363	242.825	685.919	242.912	688.478	243.002	691.039	243.096	693.603	243.194	696.169	243.296	698.738	243.402	701.309	243.512	800	
700	580.636	207.978	583.187	208.055	585.740	208.136	588.296	208.223	590.856	208.314	593.418	208.409	595.983	208.510	598.551	208.613	601.122	208.725	603.696	208.839	606.273	208.958	608.853	209.082	611.435	209.210	700	
600	490.673	173.534	493.233	173.626	495.797	173.724	498.365	173.828	500.935	173.937	503.509	174.052	506.087	174.172	508.668	174.299	511.253	174.430	513.841	174.567	516.432	174.710	519.027	174.859	521.625	175.012	600	
500	400.748	139.150	403.323	139.265	405.902	139.388	408.485	139.518	411.073	139.654	413.665	139.797	416.261	139.948	418.861	140.105	421.466	140.270	424.075	140.441	426.688	140.620	429.305	140.805	431.927	140.998	500	
450	364.796	125.424	367.378	125.552	369.966	125.688	372.558	125.833	375.154	125.984	377.756	126.144	380.363	126.311	382.973	126.486	385.589	126.668	388.209	126.858	390.834	127.057	393.463	127.262	396.097	127.476	450	
400	328.810	121.996	358.395	122.128	360.984	122.268	363.579	122.416	366.178	122.572	368.783	122.736	371.392	122.908	374.006	123.088	376.624	123.276	379.248	123.471	381.876	123.676	384.509	123.887	387.146	124.107	400	
360	310.897	104.885	313.496	105.039	316.099	105.202	318.709	105.375	321.324	105.557	323.945	105.748	326.571	105.948	329.202	106.158	331.839	106.377	334.482	106.605	337.129	106.843	339.782	107.090	342.440	107.346	360	
320	266.026	87.842	268.643	88.027	271.266	88.223	273.896	88.430	276.533	88.648	279.176	88.877	281.825	89.117	284.480	89.369	287.142	89.631	289.811	89.905	292.485	90.189	295.165	90.485	297.851	90.792	320	
280	248.095	81.054	250.722	81.255	253.355	81.467	255.995	81.692	258.643	81.929	261.297	82.178	263.958	82.439	266.625	82.712	269.300	82.997	271.981	83.294	274.669	83.604	277.363	83.925	280.064	84.258	280	
260	221.226	70.918	223.870	71.149	226.522	71.393	229.181	71.651	231.848	71.924	234.523	72.210	237.206	72.510	239.896	72.823	242.594	73.150	245.299	73.492	248.011	73.846	250.730	74.215	253.456	74.597	260	80 (P)*
240	194.404	60.864	197.071	61.133	199.747	61.422	202.431	61.726	205.125	62.045	207.827	62.381	210.538	62.733	213.257	63.102	215.984	63.486	218.720	63.885	221.463	64.302	224.219	64.735	226.974	65.183	240	
220	167.019	55.883	169.700	56.180	172.391	56.494	175.091	56.827	177.801	57.177	180.520	57.545	183.248	57.930	185.985	58.333	188.731	58.754	191.486	59.192	194.250	59.648	197.023	60.121	199.805	60.612	220	
200	154.328	46.064	157.047	46.431	159.777	46.821	162.518	47.231	165.269	47.664	168.031	48.118	170.804	48.594	173.587	49.091	176.379	49.610	179.181	50.150	181.993	50.712	184.813	51.294	187.642	51.898	200	
180	132.215	38.131	134.979	38.588	137.755	39.072	140.544	39.583	143.345	40.120	146.157	40.684	148.981	41.275	151.816	41.891	154.661	42.534	157.516	43.203	160.381	43.897	163.255	44.617	166.138	45.362	180	
160	123.423	35.066	126.210	35.572	129.010	36.108	131.824	36.674	134.649	37.268	137.487	37.892	140.336	38.545	143.196	39.227	146.067	39.937	148.947	40.675	151.837	41.441	154.737	42.235	157.644	43.057	160	50 (P)
140	114.676	32.096	117.490	32.664	120.318	33.264	123.159	33.897	126.013	34.562	128.879	35.260	131.757	35.989	134.645	36.750	137.544	37.543	140.452	38.366	143.369	39.220	146.295	40.104	149.228	41.018	140	50 (H)**
120	105.987	29.261	108.833	29.906	111.693	30.587	114.567	31.305	117.453	32.060	120.351	32.850	123.260	33.675	126.179	34.535	129.107	35.430	132.044	36.359	134.988	37.321	137.939	38.317	140.896	39.344	120	
100	97.378	26.624	100.261	27.370	103.158	28.157	106.067	28.985	108.989	29.854	111.921	30.763	114.862	31.712	117.811	32.699	120.768	33.724	123.731	34.786	126.698	35.885	129.669	37.019	132.642	38.188	100	
95	93.111	25.412	96.015	26.220	98.931	27.072	101.860	27.969	104.799	28.908	107.748	29.890	110.704	30.913	113.667	31.977	116.635	33.081	119.606	34.223	122.580	35.404	125.555	36.621	128.530	37.873	95	
90	88.876	24.297	91.800	25.178	94.737	26.106	97.684	27.082	100.640	28.103	103.603	29.169	106.572	30.279	109.544	31.430	112.518	32.624	115.494	33.857	118.468	35.129	121.439	36.438	124.407	37.784	90	40 (H)**
85	84.675	23.206	87.621	24.274	90.576	25.293	93.539	26.361	96.509	27.478	99.482	28.641	102.457	29.850	105.432	31.103	108.404	32.398	111.373	33.734	114.336	35.109	117.290	36.521	120.235	37.969	85	35 (P)*
80	80.512	22.483	83.476	23.554	86.446	24.679	89.420	25.857	92.395	27.085	95.369	28.362	98.339	29.685	101.303	31.053	104.258	32.463	107.202	33.913							80	30 (H)**
75	76.383	21.884	79.338	23.080	82.333	24.333	85.304	25.640	88.270	26.998	91.226	28.405															75	
70	74.738	21.727	77.713	22.979	80.684	24.289	83.649	25.654	86.603	27.069																	70	30 (P)*
65	72.270	21.599	75.237	22.944	78.193	24.347																					65	30 (H)**
60																											60	28 (P)*
55																											55	
50																											50	25 (H)**
45																											45	20 (P)*
40																											40	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 85 Degrees

$\Delta = 85°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h		
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	2298.329	890.858	2300.832	890.862	2303.336	890.868	2305.840	890.874	2308.345	890.881	2310.850	890.889	2313.357	890.899	2315.864	890.910	2318.372	890.922	2320.881	890.935	2323.390	890.949	2325.901	890.964	2328.412	890.980	2500	
2200	2023.431	783.937	2025.934	783.961	2028.438	783.967	2030.943	783.974	2033.448	783.982	2035.955	783.992	2038.462	784.003	2040.970	784.015	2043.479	784.029	2045.989	784.043	2048.500	784.060	2051.012	784.077	2053.524	784.095	2200	
2000	1840.165	712.689	1842.668	712.694	1845.173	712.700	1847.678	712.708	1850.184	712.718	1852.691	712.728	1855.199	712.740	1857.708	712.753	1860.218	712.768	1862.729	712.784	1865.241	712.802	1867.754	712.821	1870.268	712.842	2000	
1800	1656.899	641.421	1659.403	641.427	1661.908	641.434	1664.414	641.443	1666.921	641.453	1669.429	641.465	1671.938	641.478	1674.448	641.493	1676.959	641.510	1679.471	641.527	1681.984	641.547	1684.498	641.568	1687.013	641.591	1800	
1600	1382.001	534.521	1384.506	534.527	1387.011	534.536	1389.518	534.546	1392.027	534.558	1394.536	534.572	1397.047	534.588	1399.559	534.606	1402.072	534.626	1404.587	534.648	1407.103	534.671	1409.620	534.697	1412.138	534.724	1600	
1400	1107.104	427.620	1109.609	427.628	1112.116	427.639	1114.625	427.652	1117.135	427.667	1119.667	427.685	1122.161	427.705	1124.676	427.728	1127.192	427.752	1129.710	427.779	1132.230	427.809	1134.751	427.840	1137.274	427.875	1400	
1200	923.839	356.334	926.346	356.364	928.854	356.377	931.365	356.392	933.877	356.411	936.391	356.432	938.907	356.456	941.426	356.483	943.945	356.512	946.467	356.545	948.990	356.580	951.516	356.618	954.043	356.659	1200	
1000	832.207	320.721	834.714	320.732	837.224	320.747	839.735	320.764	842.249	320.784	844.765	320.808	847.283	320.834	849.803	320.864	852.325	320.897	854.849	320.933	857.375	320.972	859.904	321.015	862.434	321.061	1000	
800	740.575	285.089	743.083	285.101	745.594	285.117	748.107	285.137	750.623	285.159	753.140	285.186	755.660	285.216	758.183	285.250	760.708	285.287	763.235	285.327	765.764	285.371	768.296	285.419	770.830	285.470	800	
700	648.044	249.457	651.452	249.471	653.965	249.489	656.480	249.511	658.998	249.538	661.518	249.568	664.041	249.603	666.567	249.641	669.095	249.683	671.626	249.730	674.159	249.780	676.696	249.835	679.234	249.893	700	100 (P)*
600	557.312	213.826	559.824	213.843	562.338	213.864	564.855	213.890	567.375	213.920	569.899	213.956	572.426	213.996	574.956	214.040	577.489	214.090	580.025	214.144	582.564	214.203	585.106	214.266	587.651	214.335	600	
500	465.682	178.196	468.196	178.216	470.713	178.241	473.233	178.272	475.758	178.309	478.286	178.352	480.818	178.399	483.354	178.453	485.893	178.512	488.437	178.578	490.983	178.648	493.534	178.724	496.088	178.806	500	
400	374.054	142.568	376.570	142.593	379.091	142.625	381.617	142.664	384.148	142.710	386.683	142.763	389.223	142.823	391.768	142.890	394.316	142.964	396.870	143.045	399.428	143.133	401.991	143.229	404.558	143.331	400	
350	337.403	128.318	339.921	128.346	342.445	128.381	344.973	128.424	347.508	128.475	350.047	128.534	352.591	128.601	355.140	128.675	357.694	128.758	360.254	128.848	362.818	128.946	365.387	129.052	367.962	129.166	350	
300	328.240	124.756	330.759	124.784	333.283	124.821	335.813	124.865	338.348	124.917	340.888	124.978	343.433	125.046	345.984	125.123	348.540	125.208	351.101	125.301	353.667	125.402	356.238	125.510	358.815	125.627	300	
250	282.427	106.945	284.950	106.978	287.478	107.020	290.012	107.072	292.553	107.133	295.100	197.204	297.653	107.284	300.211	107.373	302.776	107.472	305.347	107.580	307.924	107.698	310.507	107.825	313.095	107.961	250	80 (P)*
230	236.617	89.136	239.143	89.176	241.677	89.227	244.218	89.289	246.767	89.362	249.323	89.447	251.886	89.543	254.456	89.650	257.033	89.769	259.618	89.899	262.209	90.040	264.808	90.192	267.413	90.356	230	
210	218.293	82.014	220.822	82.057	223.359	82.112	225.903	82.180	228.456	82.260	231.016	82.352	233.585	82.456	236.161	82.573	238.745	82.701	241.336	82.843	243.935	82.996	246.542	83.162	249.156	83.339	210	
200	190.809	71.332	193.342	71.381	195.884	71.445	198.435	71.522	200.995	71.614	203.565	71.720	206.143	71.840	208.730	71.974	211.326	72.123	213.930	72.285	216.543	72.461	219.165	72.651	221.795	72.856	200	
170	163.326	60.653	165.865	60.711	168.414	60.786	170.974	60.877	173.545	60.985	176.126	61.110	178.718	61.251	181.319	61.408	183.931	61.583	186.553	61.773	189.184	61.981	191.826	62.204	194.477	62.445	170	65 (P)*
155	149.586	55.515	152.128	55.579	154.682	55.651	157.248	55.561	159.825	55.679	162.414	55.816	165.014	55.971	167.625	56.144	170.247	56.335	172.879	56.544	175.523	56.771	178.177	57.016	180.841	57.280	155	
135	122.109	44.644	124.661	44.723	127.228	44.825	129.809	44.949	132.404	45.096	135.013	45.265	137.635	45.457	140.271	45.671	142.919	45.908	145.581	46.167	148.256	46.448	150.943	46.752	153.642	47.078	135	
100	99.218	35.761	101.282	35.860	104.365	35.987	106.965	36.142	109.582	36.326	112.216	36.537	114.867	36.776	117.533	37.044	120.216	37.339	122.913	37.662	125.626	38.013	128.353	38.391	131.095	38.797	100	
90	90.063	32.212	92.635	32.322	95.227	32.463	97.837	32.635	100.467	32.839	103.114	33.074	105.780	33.339	108.463	33.636	111.163	33.964	113.880	34.322	116.613	34.711	119.362	35.131	122.125	35.581	90	50 (P)*
80	80.912	28.666	83.492	28.790	86.094	28.948	88.718	29.142	91.362	29.371	94.027	29.635	96.711	29.934	99.414	30.267	102.136	30.635	104.876	31.038	107.633	31.474	110.407	31.945	113.197	32.450	80	50 (H)**
70	71.763	25.125	74.354	25.267	76.970	25.448	79.610	25.669	82.273	25.931	84.959	26.232	87.666	26.573	90.395	26.953	93.143	27.373	95.911	27.831	98.698	28.329	101.502	28.865	104.324	29.439	70	
60	62.619	21.592	65.225	21.757	67.859	21.968	70.520	22.226	73.207	22.531	75.920	22.882	78.657	23.278	81.417	23.721	84.199	24.208	87.002	24.741	89.825	25.319	92.667	25.940	95.527	26.603	60	40 (P)*
55	58.050	19.830	60.665	20.009	63.310	20.240	65.984	20.521	68.687	20.853	71.416	21.235	74.171	21.667	76.950	22.149	79.752	22.679	82.576	23.259	85.420	23.886	88.284	24.561	91.165	25.284	55	
50	53.483	18.071	56.106	18.269	58.767	18.522	61.457	18.831	64.177	19.196	66.925	19.615	69.701	20.089	72.502	20.618	75.327	21.199	78.174	21.834	81.042	22.521	83.929	23.260	86.834	24.049	50	40 (H)**
45	48.919	16.318	51.557	16.537	54.232	16.818	56.940	17.161	59.681	17.566	62.452	18.031	65.252	18.556	68.078	19.141	70.929	19.784	73.802	20.485	76.697	21.244	79.610	22.058	82.539	22.927	45	35 (P)*
40	44.359	14.571	47.013	14.818	49.707	15.134	52.438	15.519	55.203	15.973	58.001	16.494	60.829	17.083	63.684	17.737	66.565	18.456	69.467	19.239	72.390	20.084	75.330	20.990	78.285	21.956	40	35 (H) 30 (P)*
35	39.805	12.835	42.479	13.116	45.197	13.477	47.956	13.916	50.751	14.432	53.581	15.026	56.442	15.694	59.330	16.436	62.243	17.250	65.177	18.137	68.129	19.088	71.095	20.107	74.072	21.191	35	
33	37.986	12.144	40.670	12.442	43.399	12.824	46.170	13.289	48.979	13.836	51.824	14.464	54.699	15.170	57.602	15.954	60.529	16.813	63.475	17.746	66.438	18.749	69.414	19.822	72.397	20.960	33	
30	35.260	11.113	37.960	11.441	40.708	11.860	43.501	12.371	46.334	12.970	49.202	13.657	52.101	14.429	55.026	15.285	57.974	16.221	60.939	17.235	63.916	18.324	66.902	19.485	69.892	20.715	30	30 (H)**
25	30.728	9.416	33.463	9.808	36.251	10.309	39.087	10.917	41.965	11.630	44.878	12.444	47.819	13.356	50.782	14.362	53.761	15.459	56.748	16.641	59.736	17.903	62.723	19.241	65.697	20.650	25	
23	28.921	8.747	31.672	9.172	34.480	9.715	37.337	10.374	40.235	11.144	43.167	12.023	46.126	13.005	49.102	14.086	52.089	15.260	55.078	16.523	58.063	17.868	61.035	19.288			23	23 (P)*
20	26.219	7.759	29.001	8.247	31.842	8.868	34.734	9.619	37.665	10.495	40.626	11.490	43.606	12.597	46.594	13.810	49.582	15.120	52.558	16.520							20	25 (H)**
15	21.751	6.185	24.601	6.828	27.513	7.642	30.469	8.617	33.451	9.742	36.440	11.005	39.418	12.390													15	20 (P)*
14	20.865	5.888	23.732	6.574	26.660	7.441	29.629	8.476	32.616	9.667	35.601	10.997															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 85 Degrees **$\Delta = 85°$**

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2330.924	890.996	2333.436	891.017	2335.949	891.037	2338.463	891.057	2340.978	891.080	2343.494	891.103	2346.010	891.127	2348.527	891.152	2351.045	891.179	2353.563	891.207	2356.083	891.236	2358.603	891.265	2361.124	891.296	2500	
2200	2056.037	784.115	2058.552	784.136	2061.067	784.159	2063.583	784.183	2066.100	784.208	2068.617	784.234	2071.136	784.262	2073.655	784.291	2076.175	784.321	2078.696	784.352	2081.218	784.385	2083.741	784.419	2086.264	784.454	2200	
2000	1872.782	712.864	1875.298	712.887	1877.815	712.912	1880.332	712.938	1882.851	712.965	1885.370	712.994	1887.890	713.025	1890.412	713.056	1892.934	713.090	1895.457	713.124	1897.981	713.160	1900.506	713.198	1903.032	713.236	2000	
1800	1689.530	641.615	1692.047	641.641	1694.565	641.669	1697.085	641.698	1699.605	641.728	1702.127	641.760	1704.650	641.794	1707.173	641.830	1709.698	641.866	1812.224	641.905	1714.750	641.945	1717.278	641.987	1719.807	642.030	1800	
1500	1414.657	534.753	1417.178	534.784	1419.701	534.817	1422.224	534.852	1424.748	534.889	1427.274	534.927	1429.801	534.968	1432.329	535.010	1434.859	535.054	1437.390	535.101	1439.922	535.149	1442.455	535.198	1444.989	535.250	1500	
1200	1139.799	427.911	1142.325	427.950	1144.852	427.991	1147.381	428.034	1149.912	428.081	1152.444	428.129	1154.978	428.179	1157.513	428.232	1160.050	428.288	1162.588	428.345	1165.128	428.405	1167.669	428.468	1170.212	428.532	1200	
1000	956.573	356.703	959.104	356.750	961.637	356 799	964.171	356.851	966.708	356.906	969.246	356.964	971.787	357.025	974.329	357.089	976.873	357.155	979.419	357.224	981.967	357.296	984.516	357.371	987.067	357.449	1000	
900	864.966	321.109	867.501	321.161	870.037	321.216	872.576	321.274	875.116	321.335	877.659	321.399	880.204	321.467	882.750	321.537	885.299	321.611	887.850	321.688	890.403	321.768	892.958	321 851	895.514	321.938	900	
800	773.366	285.525	775.905	285.583	778.446	285.645	780.989	285.710	783.535	285.779	786.083	285.852	788.633	285.928	791.185	286.007	793.740	286.090	796.297	286.177	798.856	286.267	801.418	286.360	803.982	286.457	800	
700	681.776	249.956	684.320	250.022	686.867	250.093	689.416	250.167	691.968	250.246	694.523	250.329	697.080	250.416	699.640	250.507	702.202	250.601	704.767	250.700	707.334	250.803	709.904	250.910	712.477	251.021	700	
600	590.199	214.407	592.751	214.485	595.305	214.568	597.863	214.655	600.423	214.747	602.986	214.843	605.553	214.944	608.122	215.050	610.694	215.161	613.270	215.276	615.848	215.396	618.429	215.521	621.013	215.650	600	
500	498.645	178.894	501.206	178.987	503.771	179.086	506.340	179.191	508.912	179.301	511.488	179.417	514.066	179.538	516.649	179.665	519.236	179.798	521.825	179.936	524.418	180.080	527.015	180.229	529.615	180.384	500	
450	407.129	143.440	409.706	143.557	412.286	143.680	414.871	143.811	417.460	143.948	420.054	144.093	422.652	144.245	425.254	144.404	427.861	144.569	430.471	144.742	433.087	144.922	435.706	145.109	438.330	145.303	450	
400	370.541	129.287	373.125	129.416	375.714	129.554	378.308	129.699	380.906	129.852	383.510	130.012	386.119	130.181	388.731	130.357	391.349	130.541	393.971	130.733	396.599	130.933	399.230	131.140	401.867	131.355	400	100 (P)*
350	331.396	125.752	363.983	125.885	366.574	126.026	369.170	126.176	371.772	126.333	374.378	126.498	376.989	126.672	379.605	126.853	382.226	127.042	384.852	127.240	387.482	127.445	390.118	127.658	392.758	127.880	350	
300	315.689	108.107	318.290	108.262	320.896	108.427	323.507	108.601	326.124	108.784	328.747	108.977	331.376	109.179	334.010	109.391	336.649	109.611	339.294	109.841	341 945	110.081	344.601	110.329	347.262	110.588	300	
250	270.025	90.531	272.644	90.717	275.270	90.914	277.902	91.123	280.541	91.343	283.187	91.574	285.839	91.816	288.497	92.069	291.162	92.334	293.833	92.610	296.511	92.896	299.195	93.195	301.885	93.504	250	
230	251.777	83.529	254.406	83.732	257.042	83.946	259.684	84.173	262.334	84.412	264.992	84.663	267.656	84.926	270.327	85.201	273.005	85.488	275.689	85.788	278.381	86.099	281.079	86.423	283.783	86.759	230	80 (P)*
200	224.433	73.074	227.079	73.307	229.734	73.553	232.396	73.813	235.067	74.088	237.745	74.376	240.431	74.678	243.125	74.994	245.827	75.324	248.536	75.668	251.252	76.026	253.976	76.397	256.707	76.782	200	
170	197.137	62.701	199.807	62.975	202.486	63.264	205.174	63.570	207.871	63.892	210.577	64.231	213.292	64.586	216.016	64 957	218.748	65.344	221.488	65.747	224.237	66.167	226.993	66.603	229 758	67.054	170	
155	183.515	57.561	186.200	57.860	188.894	58.177	191.599	58.512	194.312	58.865	197.036	59.236	199.768	59.625	202.510	60.031	205.261	60.455	208.021	60.897	210.789	61.356	213.566	61.833	216.351	62.327	155	65 (P)*
125	156.353	47.426	159.076	47.796	161.810	48.188	164.556	48.602	167.313	49.038	170.080	49.496	172.859	49.976	175.647	50.477	178.446	51.000	181.254	51.544	184.072	52.110	186.900	52.697	189.736	53.306	125	
100	133.850	39.230	136.619	39.691	139.401	40.179	142.196	40.694	145.003	41.235	147.823	41.804	150.653	42.399	153.495	43.021	156.348	43.668	159.211	44.342	162.034	45.042	164.967	45.778	167.859	46.519	100	
90	124.904	36.061	127.697	36.572	130.503	37.112	133.323	37.682	136.156	38.281	139.001	38.910	141.857	39.568	144.726	40.255	147.605	40.971	150.494	41.715	153.393	42.487	156.302	43.288	159.219	44.116	90	50 (P)
80	116.003	32.988	118.823	33.560	121.658	34.165	124.507	34.803	127.369	35.474	130.243	36.177	133.129	36.912	136.027	37.679	138.935	38.478	141.853	39.308	144.780	40.168	147.716	41.060	150.660	41.981	80	50 (H)**
70	107.162	30.051	110 016	30.701	112.884	31.388	115.766	32.112	118.661	32.872	121.568	33.668	124.487	34.500	127.416	35.367	130.355	36.269	133.302	37.206	136.258	38.175	139.221	39.179	142.190	40.215	70	
60	98.403	27.314	101.295	28.065	104.201	28.858	107.121	29.693	110.052	30.569	112.995	31.486	115.948	32.442	118.909	33.436	121.877	34.470	124.852	35.540	127.833	36.648	130.817	37.791	133.804	38.970	60	40 (P) *
55	94.063	26.052	96.976	26.866	99.903	27.726	102.842	28.629	105.793	29.576	108.753	30.566	111.721	31.597	114.696	32.670	117.677	33.782	120.662	34.933	123.650	36.123	126.640	37.350	129.630	38.612	55	
50	89.755	24.888	92.690	25.776	95.638	26.712	98.596	27.695	101.564	28.725	104.540	29.799	107.522	30.917	110.508	32.079	113.496	33.281	116.486	34.524	119.475	35.806	122.462	37.126	125.446	38.483	50	40 (H)**
45	85.484	23.850	88.441	24.825	91.408	25.852	94.384	26.929	97.366	28.055	100.353	29.227	103.343	30.446	106.332	31.709	109.320	33.014	112.305	34.360	115.284	35.746	118.255	37.170	121.217	38.629	45	35 (P)*
40	81.252	22.980	84.228	24.060	87.211	25.194	90.199	26.381	93.189	27.619	96.178	28.906	99.164	30.240	102.141	31.619	105.116	33.040	108.077	34.501							40	30 (H)**
35	77.057	22.337	80.045	23.543	83.035	24.805	86.022	26.123	89.004	27.492	91.976	28.910															35	
33	75.386	22.162	78.376	23.425	81.362	24.745	84.343	26.120	87.314	27.547																	33	30 (P)*
30	72.880	22.009	75.863	23.366	78.837	24.780																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 86 Degrees

$\Delta = 86°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2338.789	918.322	2341.292	918.326	2343.795	918.331	2346.300	918.337	2348.805	918.345	2351.311	918.353	2353.817	918.363	2356.324	918.374	2358.833	918.386	2361.341	918.399	2363.851	918.413	2366.362	918.429	2368.873	918.445	2500	
2200	2059.035	808.125	2061.538	808.129	2064.042	808.135	2066.547	808.142	2069.053	808.151	2071.560	808.160	2074.067	808.171	2076.575	808.184	2079.085	808.197	2081.595	808.212	2084.106	808.228	2086.618	808.245	2089.130	808.264	2200	
2000	1872.533	734.660	1875.036	734.665	1877.541	734.671	1880.046	734.679	1882.552	734.688	1885.060	734.699	1887.568	734.711	1890.077	734.725	1892.587	734.740	1895.098	734.756	1897.610	734.774	1900.124	734.793	1902.637	734.814	2000	
1800	1686.031	661.195	1688.534	661.201	1691.039	661.208	1693.545	661.217	1696.052	661.227	1698.560	661.239	1701.069	661.252	1703.579	661.267	1706.091	661.284	1708.603	661.302	1711.117	661.322	1713.631	661.343	1716.146	661.366	1800	
1600	1406.277	550.999	1408.782	551.005	1411.288	551.014	1413.795	551.024	1416.303	551.037	1418.813	551.051	1421.323	551.067	1423.836	551.085	1426.349	551.105	1428.864	551.127	1431.380	551.151	1433.898	551.176	1436.416	551.204	1600	
1400	1126.524	440.803	1129.030	440.811	1131.537	440.822	1134.046	440.835	1136.557	440.850	1139.069	440.868	1141.583	440.888	1144.098	440.911	1146.615	440.936	1149.133	440.963	1151.653	440.993	1154.175	441.025	1156.698	441.059	1400	
1200	940.022	367.339	942.530	367.349	945.039	367.363	947.549	367.378	950.062	367.396	952.576	367.418	955.093	367.442	957.611	367.469	960.131	367.499	962.653	367.532	965.177	367.567	967.703	367.606	970.231	367.647	1200	
1000	846.773	330.608	849.280	330.619	851.790	330.634	854.302	330.651	856.815	330.672	859.332	330.695	861.850	330.722	864.370	330.752	866.893	330.786	869.417	330.822	871.944	330.862	874.473	330.904	877.004	330.950	1000	
900	733.522	293.877	736.031	293.890	738.542	293.906	761.055	293.926	763.571	293.948	766.089	293.975	768.609	294.006	771.132	294.039	773.657	294.077	776.185	294.118	778.715	294.162	781.247	294.210	783.782	294.262	900	
800	660.272	257.147	662.782	257.161	665.294	257.179	667.810	257.202	670.328	257.229	672.848	257.259	675.372	257.294	677.898	257.332	680.426	257.375	682.958	257.422	685.492	257.473	688.029	257.528	690.568	257.586	800	100 (P)*
700	567.023	220.417	569.534	220.434	572.049	220.456	574.567	220.481	577.087	220.512	579.611	220.548	582.139	220.588	584.669	220.633	587.202	220.683	589.739	220.738	592.279	220.797	594.822	220.861	597.368	220.930	700	
600	473.775	183.689	476.288	183.709	478.805	183.734	481.326	183.766	483.852	183.803	486.380	183.846	488.913	183.894	491.449	183.948	493.990	184.008	496.533	184.074	499.081	184.145	501.632	184.221	504.187	184.304	600	
500	380.528	146.963	383.044	146.988	385.566	147.020	388.092	147.059	390.624	147.105	393.159	147.159	395.700	147.219	398.245	147.287	400.795	147.361	403.350	147.443	405.909	147.532	408.472	147.628	411.041	147.731	500	
450	343.229	132.273	345.748	132.301	348.272	132.336	350.801	132.380	353.336	132.432	355.876	132.491	358.421	132.558	360.971	132.633	363.526	132.716	366.087	132.807	368.652	132.906	371.223	133.013	373.798	133.128	450	
400	333.905	128.601	336.424	128.629	338.949	128.666	341.479	128.711	344.014	128.764	346.555	128.825	349.102	128.894	351.653	128.971	354.210	129.057	356.772	129.150	359.340	129.252	361.912	129.362	364.490	129.480	400	
350	287.283	110.241	289.806	110.274	292.334	110.317	294.870	110.369	297.411	110.431	299.958	110.502	302.512	110.583	305.072	110.673	307.638	110.772	310.210	110.881	312.789	111.000	315.373	111.128	317.963	111.266	350	80 (P)*
300	240.663	91.883	243.190	91.923	245.725	91.974	248.267	92.037	250.816	92.111	253.373	92.196	255.937	92.293	258.509	92.401	261.087	92.521	263.673	92.652	266.267	92.794	268.867	92.948	271.474	93.113	300	
250	222.016	84.541	224.545	84.584	227.083	84.640	229.628	84.708	232.182	84.789	234.743	84.881	237.313	84.987	239.891	85.104	242.476	85.234	245.069	85.376	247.670	85.531	250.278	85.698	252.894	85.877	250	
200	194.046	73.530	196.580	73.579	199.123	73.643	201.675	73.722	204.236	73.814	206.807	73.921	209.387	74.042	211.975	74.177	214.573	74.326	217.179	74.490	219.794	74.668	222.418	74.860	225.050	75.066	200	
170	166.078	62.521	168.618	62.580	171.168	62.655	173.729	62.747	176.301	62.856	178.884	62.981	181.477	63.124	184.080	63.283	186.694	63.458	189.318	63.651	191.952	63.860	194.596	64.085	197.250	64.327	170	65 (P)*
155	152.096	57.018	154.639	57.083	157.194	57.165	159.761	57.266	162.339	57.386	164.929	57.523	167.531	57.679	170.144	57.854	172.768	58.046	175.404	58.257	178.050	58.486	180.706	58.733	183.374	58.999	155	
125	124.133	46.018	126.666	46.098	129.254	46.201	131.837	46.328	134.433	46.474	137.044	46.644	139.669	46.838	142.307	47.054	144.959	47.292	147.623	47.553	150.301	47.837	152.992	48.143	155.695	48.471	125	
100	100.837	36.861	103.403	36.960	105.988	37.089	108.590	37.245	111.209	37.430	113.846	37.643	116.499	37.884	119.169	38.154	121.854	38.451	124.556	38.777	127.273	39.131	130.005	39.512	132.751	39.921	100	
90	91.522	33.202	94.095	33.313	96.688	33.455	99.301	33.629	101.932	33.834	104.583	34.070	107.252	34.338	109.938	34.638	112.643	34.968	115.364	35.329	118.101	35.721	120.855	36.145	123.624	36.598	90	50 (P)*
80	82.208	29.546	84.790	29.671	87.394	29.831	90.020	30.026	92.667	30.257	95.335	30.523	98.023	30.824	100.730	31.160	103.456	31.531	106.201	31.937	108.963	32.377	111.743	32.852	114.539	33.361	80	50 (H)**
70	72.898	25.896	75.491	26.028	78.109	26.221	80.752	26.444	83.418	26.708	86.107	27.011	88.819	27.355	91.551	27.738	94.305	28.161	97.078	28.624	99.871	29.125	102.682	29.665	105.511	30.244	70	
60	63.593	22.253	66.200	22.419	68.837	22.632	71.501	22.892	74.192	23.202	76.909	23.563	79.651	23.953	82.416	24.399	85.204	24.890	88.013	25.428	90.843	26.010	93.692	26.636	96.560	27.302	60	40 (P)*
55	58.942	20.436	61.560	20.617	64.208	20.849	66.885	21.133	69.592	21.467	72.325	21.853	75.085	22.288	77.870	22.774	80.679	23.309	83.510	23.893	86.361	24.525	89.233	25.206	92.123	25.934	55	
50	54.295	18.822	56.923	18.821	59.584	19.077	62.278	19.389	65.002	19.756	67.756	20.179	70.537	20.657	73.344	21.190	76.176	21.776	79.031	22.416	81.907	23.108	84.804	23.853	87.718	24.648	50	40 (H)**
45	49.650	16.814	52.291	17.015	54.959	17.319	57.682	17.665	60.427	18.072	63.204	18.541	66.010	19.071	68.843	19.660	71.702	20.309	74.584	21.016	77.487	21.780	80.410	22.601	83.350	23.477	45	35 (P)*
40	45.010	15.013	47.667	15.262	50.365	15.580	53.100	15.969	55.871	16.426	58.675	16.952	61.510	17.545	64.373	18.205	67.262	18.930	70.174	19.719	73.107	20.571	76.058	21.484	79.024	22.458	40	35 (H) 30 (P)*
35	40.376	13.222	43.054	13.506	45.776	13.869	48.539	14.312	51.341	14.833	54.178	15.431	57.047	16.104	59.944	16.853	62.867	17.673	65.811	18.565	68.774	19.526	71.753	20.554	74.743	21.646	35	
33	38.525	12.510	41.212	12.810	43.946	13.195	46.722	13.664	49.538	14.216	52.390	14.848	55.274	15.560	58.186	16.350	61.123	17.217	64.081	18.157	67.056	19.168	70.044	20.249	73.041	21.397	33	
30	35.751	11.446	38.455	11.776	41.208	12.199	44.007	12.714	46.846	13.318	49.722	14.011	52.631	14.789	55.567	15.651	58.525	16.595	61.502	17.617	64.493	18.715	67.497	19.886	70.497	21.125	30	20 (H)**
25	31.139	9.654	33.878	10.090	36.672	10.595	39.516	11.208	42.402	11.926	45.324	12.747	48.277	13.667	51.252	14.681	54.244	15.786	57.245	16.978	60.250	18.251	63.251	19.600	66.262	21.020	25	
23	29.300	9.004	32.056	9.433	34.871	9.980	37.735	10.644	40.643	11.421	43.583	12.306	46.555	13.297	49.544	14.386	52.545	15.570	55.550	16.843	58.550	18.199	61.559	19.630			23	25 (P)*
20	26.550	7.984	29.338	8.476	32.187	9.102	35.087	9.859	38.029	10.742	41.002	11.745	43.995	12.861	46.998	14.084	50.001	15.404	52.994	16.816							20	25 (H)**
15	22.003	6.357	24.861	7.005	27.783	7.826	30.751	8.809	33.746	9.943	36.750	11.215	39.745	12.612													15	20 (P)*
14	21.102	6.049	23.978	6.741	26.916	7.615	29.897	8.659	32.899	9.858	35.900	11.199															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 86 Degrees

$\Delta = 86°$

Rc	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		Rc	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metres																												
2500	2371.385	918.463	2373.897	918.481	2376.411	918.501	2378.925	918.522	2381.440	918.545	2383.956	918.568	2386.473	918.593	2388.990	918.618	2391.508	918.645	2394.027	918.673	2396.547	918.702	2399.067	918.732	2401.589	918.763	2500	
2200	2091.644	808.284	2094.158	808.306	2096.674	808.328	2099.190	808.353	2101.707	808.378	2104.225	808.404	2106.744	808.432	2109.264	808.461	2111.784	808.492	2114.306	808.523	2116.828	808.556	2119.351	808.591	2121.875	808.626	2200	
2000	1900.132	734.826	1907.668	734.859	1910.185	734.884	1912.703	734.910	1915.222	734.938	1917.741	734.968	1920.262	734.998	1922.784	735.030	1925.307	735.064	1927.830	735.098	1930.354	735.135	1932.880	735.173	1935.406	735.212	2000	
1800	1718.663	661.391	1721.181	661.417	1723.699	661.445	1726.219	661.474	1728.740	661.505	1731.262	661.537	1733.785	661.571	1736.309	661.607	1738.834	661.644	1741.360	661.683	1743.887	661.723	1746.416	661.765	1748.945	661.808	1800	
1500	1438.936	551.233	1441.457	551.264	1443.980	551.298	1446.504	551.333	1449.029	551.370	1451.555	551.409	1454.083	551.450	1456.611	551.492	1459.141	551.537	1461.673	551.584	1464.205	551.632	1466.739	551.682	1469.274	551.735	1500	
1200	1150.223	441.096	1161.750	441.135	1164.277	441.177	1166.807	441.220	1169.338	441.267	1171.871	441.315	1174.405	441.367	1176.941	441.420	1179.479	441.476	1182.017	441.534	1184.558	441.594	1187.100	441.657	1189.644	441.722	1200	
1000	972.761	367.691	975.282	367.738	977.826	367.788	980.361	367.841	982.899	367.896	985.437	367.955	987.979	368.016	990.522	368.080	993.067	368.147	995.613	368.217	998.162	368.290	1000.712	368.365	1003.264	368.443	1000	
900	879.537	330.999	882.072	331.052	884.609	331.107	887.148	331.165	889.689	331.227	892.233	331.292	894.778	331.360	897.326	331.431	899.875	331.505	902.427	331.583	904.981	331.664	907.537	331.747	910.095	331.834	900	
800	786.319	294.317	788.858	294.376	791.400	294.438	793.944	294.504	796.491	294.573	799.039	294.646	801.591	294.723	804.144	294.803	806.699	294.886	809.258	294.974	811.817	295.064	814.380	295.159	816.945	295.257	800	
700	693.111	257.649	695.656	257.717	698.204	257.788	700.753	257.863	703.306	257.943	705.862	258.026	708.420	258.113	710.981	258.205	713.544	258.301	716.110	258.400	718.679	258.504	721.250	258.612	723.824	258.723	700	
600	599.917	221.004	602.469	221.082	605.025	221.165	607.583	221.253	610.145	221.345	612.709	221.443	615.277	221.545	617.847	221.652	620.421	221.763	622.997	221.879	625.577	222.000	628.160	222.126	630.745	222.256	600	
500	506.746	184.392	509.308	184.486	511.874	184.586	514.444	184.692	517.017	184.802	519.594	184.919	522.175	185.041	524.759	185.170	527.347	185.303	529.938	185.443	532.533	185.588	535.132	185.739	537.733	185.895	500	
400	413.614	147.842	416.191	147.959	418.773	148.084	421.360	148.216	423.950	148.354	426.546	148.500	429.146	148.653	431.750	148.813	434.358	148.980	436.971	149.154	439.589	149.335	442.210	149.524	444.836	149.719	400	
360	376.379	133.250	378.903	133.380	381.555	133.519	384.151	133.665	386.751	133.819	389.357	133.981	391.967	134.151	394.582	134.329	397.202	134.514	399.827	134.708	402.457	134.909	405.091	135.118	407.729	135.335	360	100 (P)*
350	367.073	129.605	369.661	129.740	372.254	129.882	374.852	130.032	377.456	130.191	380.064	130.358	382.677	130.532	385.295	130.715	387.918	130.906	390.546	131.105	393.179	131.312	395.817	131.527	398.459	131.750	350	
300	320.559	111.413	323.161	111.569	325.769	111.735	328.383	111.910	331.002	112.095	333.627	112.289	336.258	112.493	338.895	112.706	341.537	112.929	344.185	113.161	346.838	113.402	349.497	113.653	35..161	113.913	300	
250	274.088	93.289	276.709	93.477	279.337	93.676	281.972	93.886	284.614	94.107	287.262	94.340	289.917	94.584	292.579	94.840	295.247	95.106	297.922	95.385	300.603	95.674	303.290	95.974	305.984	96.286	250	
230	235.518	86.069	258.149	86.273	260.787	86.489	263.433	86.717	266.086	86.958	268.746	87.211	271.414	87.476	274.088	87.754	276.769	88.043	279.458	88.345	282.152	88.659	284.854	88.986	287.563	89.324	230	80 (P)*
200	227.691	75.286	230.340	75.520	232.998	75.769	235.663	76.031	238.337	76.306	241.019	76.598	243.709	76.903	246.406	77.221	249.112	77.554	251.825	77.901	254.546	78.261	257.274	78.636	260.009	79.024	200	
170	190.914	64.586	202.587	64.961	205.269	65.353	207.961	65.462	210.662	65.786	213.372	66.128	216.091	66.485	218.819	66.860	221.556	67.250	224.301	67.657	227.054	68.080	229.816	68.519	232.586	68.974	170	
135	186.052	59.282	188.740	59.584	191.438	59.904	194.146	60.242	196.864	60.598	199.592	60.971	202.329	61.363	205.076	61.773	207.832	62.200	210.597	62.646	213.370	63.109	216.153	63.589	218.944	64.088	135	65 (P)*
125	158.410	48.822	161.138	49.195	163.877	49.591	166.627	50.008	169.389	50.448	172.163	50.909	174.946	51.393	177.741	51.898	180.546	52.425	183.361	52.974	186.186	53.544	189.020	54.136	191.864	54.750	125	
100	135.512	40.338	138.286	40.822	141.074	41.314	143.875	41.833	146.689	42.379	149.515	42.952	152.352	43.552	155.202	44.179	158.062	44.832	160.933	45.511	163.815	46.217	166.706	46.948	169.607	47.706	100	
90	126.408	37.082	129.207	37.597	132.020	38.141	134.846	38.716	137.686	39.320	140.539	39.954	143.403	40.618	146.280	41.310	149.167	42.032	152.066	42.782	154.974	43.560	157.892	44.367	160.819	45.202	90	50 (P)
80	117.351	33.903	120.178	34.480	123.021	35.090	125.877	35.733	128.747	36.409	131.630	37.118	134.524	37.859	137.431	38.632	140.349	39.438	143.276	40.274	146.214	41.142	149.161	42.040	152.115	42.969	80	30 (H)**
70	108.356	30.861	111.217	31.516	114.093	32.209	116.984	32.939	119.889	33.705	122.805	34.508	125.734	35.347	128.673	36.221	131.623	37.130	134.582	38.074	137.549	39.052	140.524	40.063	143.505	41.107	70	
60	99.445	28.021	102.346	28.778	105.261	29.578	108.191	30.420	111.133	31.303	114.087	32.227	117.051	33.190	120.024	34.193	123.005	35.235	125.992	36.314	128.986	37.431	131.984	38.583	134.985	39.771	60	40 (P)*
55	95.030	26.709	97.953	27.529	100.890	28.396	103.840	29.306	106.802	30.261	109.774	31.259	112.754	32.299	115.742	33.380	118.737	34.501	121.733	35.662	124.738	36.861	127.742	38.098	130.747	39.371	55	
50	90.649	25.494	93.594	26.390	96.552	27.333	99.524	28.325	102.504	29.362	105.492	30.445	108.487	31.573	111.487	32.743	114.490	33.956	117.495	35.209	120.499	36.501	123.502	37.832	126.501	39.199	50	40 (H)**
45	86.305	24.408	89.274	25.391	92.253	26.426	95.242	27.512	98.238	28.646	101.239	29.829	104.243	31.057	107.248	32.330	110.251	33.646	113.252	35.003	116.247	36.400	119.236	37.835	122.215	39.306	45	35 (P)*
40	82.003	23.490	84.992	24.579	87.989	25.722	90.991	26.915	93.996	28.167	97.000	29.464	100.002	30.809	103.008	32.199	105.987	33.631	108.966	35.105							40	30 (H)**
35	77.741	22.801	80.744	24.017	83.749	25.290	86.751	26.618	89.759	27.998	92.739	29.427															35	
33	76.044	22.609	79.049	23.882	82.051	25.213	85.048	26.599	88.036	28.037																	33	30 (P)*
30	73.501	22.431	76.500	23.798	79.490	25.223																					30	30 (H)**
25																											25	25 (H)**
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 87 Degrees

$\Delta = 87°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	2379.912	946.500	2382.415	946.505	2384.919	946.510	2387.423	946.516	2389.928	946.524	2392.434	946.532	2394.941	946.542	2397.448	946.553	2399.957	946.565	2402.466	946.578	2404.975	946.593	2407.486	946.608	2409.998	946.625	2500	
2200	2095.224	832.922	2097.727	832.927	2100.231	832.932	2102.736	832.940	2105.242	832.948	2107.749	832.958	2110.256	832.969	2112.765	832.981	2115.274	832.995	2117.784	833.010	2120.296	833.026	2122.808	833.044	2125.321	833.063	2200	
2000	1905.432	757.203	1907.935	757.208	1910.439	757.214	1912.945	757.222	1915.451	757.232	1917.959	757.242	1920.467	757.255	1922.977	757.268	1925.487	757.283	1927.998	757.300	1930.510	757.318	1933.024	757.337	1935.538	757.358	2000	
1800	1715.639	681.484	1718.143	681.490	1720.648	681.497	1723.154	681.505	1725.661	681.516	1728.170	681.528	1730.679	681.542	1733.189	681.557	1735.701	681.573	1738.213	681.592	1740.727	681.612	1743.242	681.633	1745.757	681.656	1800	
1500	1430.951	567.906	1433.456	567.913	1435.962	567.921	1438.469	567.932	1440.978	567.944	1443.488	567.958	1445.999	567.975	1448.511	567.993	1451.025	568.013	1453.540	568.035	1456.056	568.059	1458.574	568.085	1461.093	568.113	1500	
1200	1146.264	454.329	1148.770	454.337	1151.277	454.348	1153.786	454.361	1156.297	454.376	1158.809	454.395	1161.323	454.415	1163.839	454.438	1166.355	454.463	1168.874	454.490	1171.395	454.520	1173.917	454.552	1176.440	454.587	1200	
1000	956.472	378.611	958.979	378.621	961.488	378.634	963.999	378.650	966.512	378.668	969.027	378.690	971.543	378.715	974.062	378.742	976.582	378.772	979.105	378.805	981.629	378.841	984.156	378.880	986.684	378.921	1000	
900	861.577	340.753	864.085	340.764	866.595	340.779	869.107	340.796	871.621	340.816	874.137	340.840	876.656	340.868	879.176	340.898	881.699	340.932	884.224	340.968	886.751	341.008	889.281	341.051	891.812	341.097	900	
800	766.682	302.895	769.191	302.907	771.702	302.923	774.215	302.943	776.731	302.966	779.249	302.993	781.771	303.024	784.294	303.058	786.819	303.096	789.347	303.137	791.878	303.182	794.411	303.230	796.946	303.282	800	
700	671.787	265.037	674.297	265.052	676.810	265.070	679.325	265.093	681.844	265.119	684.364	265.150	686.888	265.185	689.415	265.224	691.944	265.267	694.476	265.314	697.011	265.365	699.548	265.421	702.088	265.480	700	100 (P)*
600	576.893	227.180	579.405	227.197	581.919	227.219	584.437	227.245	586.958	227.276	589.483	227.312	592.011	227.353	594.542	227.398	597.075	227.448	599.613	227.504	602.154	227.563	604.697	227.628	607.244	227.698	600	
500	482.000	189.323	484.513	189.345	487.031	189.371	489.552	189.402	492.078	189.440	494.607	189.483	497.140	189.532	499.677	189.586	502.218	189.646	504.763	189.713	507.311	189.784	509.864	189.862	512.419	189.945	500	
400	387.108	151.472	389.625	151.497	392.147	151.529	394.674	151.569	397.205	151.615	399.742	151.669	402.283	151.730	404.829	151.798	407.380	151.874	409.936	151.956	412.496	152.046	415.061	152.143	417.630	152.247	400	
360	349.152	136.931	351.671	136.959	354.195	136.995	356.725	136.439	359.260	138.491	361.801	136.551	364.346	136.618	366.897	136.694	369.454	136.778	372.015	136.870	374.582	136.969	377.154	137.077	379.731	137.193	360	
320	339.663	132.546	342.182	132.575	344.708	132.612	347.238	132.657	349.774	132.710	352.316	132.772	354.863	132.842	357.416	132.920	359.973	133.006	362.537	133.100	365.105	133.203	367.679	133.313	370.258	133.432	320	
300	292.219	113.623	294.741	113.656	297.271	113.699	299.805	113.752	302.345	113.814	304.897	113.886	307.452	113.967	310.013	114.058	312.580	114.158	315.153	114.268	317.733	114.388	320.319	114.517	322.910	114.656	300	80 (P)*
250	244.776	94.701	247.304	94.741	249.839	94.793	252.381	94.856	254.932	94.931	257.490	95.017	260.055	95.115	262.628	95.224	265.208	95.344	267.796	95.476	270.390	95.620	272.992	95.775	275.602	95.941	250	
230	225.800	87.134	228.330	87.177	230.868	87.234	233.414	87.302	235.969	87.384	238.532	87.477	241.102	87.583	243.681	87.702	246.268	87.833	248.863	87.976	251.466	88.132	254.076	88.300	256.695	88.481	230	
200	197.337	75.784	199.871	75.834	202.415	75.899	204.968	75.978	207.530	76.071	210.102	76.179	212.683	76.301	215.274	76.437	217.874	76.588	220.481	76.753	223.099	76.932	225.725	77.125	228.359	77.333	200	
170	168.876	64.438	171.416	64.497	173.967	64.573	176.529	64.666	179.102	64.775	181.687	64.902	184.281	65.046	186.887	65.206	189.503	65.383	192.129	65.577	194.766	65.787	197.412	66.015	200.069	66.259	170	65 (P)*
155	154.646	58.766	157.190	58.831	159.746	58.914	162.314	59.016	164.894	59.136	167.486	59.275	170.090	59.433	172.705	59.608	175.331	59.802	177.969	60.015	180.618	60.246	183.278	60.495	185.948	60.763	155	
125	126.191	47.428	128.745	47.509	131.314	47.612	133.898	47.738	136.496	47.887	139.109	48.059	141.736	48.254	144.377	48.472	147.031	48.712	149.699	48.976	152.381	49.262	155.075	49.570	157.782	49.901	125	
100	102.444	37.999	105.051	38.090	107.637	38.219	110.241	38.376	112.862	38.563	115.501	38.778	118.158	39.021	120.831	39.293	123.520	39.593	126.225	39.921	128.947	40.278	131.683	40.662	134.434	41.075	100	
90	93.004	34.217	95.578	34.329	98.173	34.472	100.788	34.648	103.422	34.855	106.076	35.093	108.748	35.365	111.438	35.665	114.146	35.998	116.871	36.362	119.614	36.758	122.372	37.184	125.147	37.642	90	50 (P)*
80	83.526	30.449	86.109	30.575	88.716	30.736	91.344	30.933	93.994	31.166	96.665	31.434	99.356	31.738	102.067	32.077	104.798	32.451	107.547	32.860	110.315	33.304	113.100	33.782	115.903	34.295	80	50 (H)**
70	74.052	26.686	76.646	26.830	79.267	27.014	81.912	27.239	84.581	27.505	87.274	27.811	89.990	28.157	92.727	28.544	95.486	28.971	98.265	29.437	101.064	29.942	103.881	30.487	106.717	31.071	70	
60	64.582	22.931	67.192	23.098	69.831	23.313	72.498	23.576	75.193	23.885	77.914	24.242	80.661	24.645	83.431	25.095	86.225	25.590	89.041	26.132	91.878	26.719	94.735	27.350	97.610	28.027	60	40 (P)*
55	59.850	21.058	62.469	21.240	65.120	21.474	67.801	21.760	70.512	22.098	73.250	22.486	76.015	22.925	78.806	23.415	81.621	23.954	84.459	24.543	87.318	25.181	90.198	25.867	93.097	26.601	55	
50	55.120	19.188	57.751	19.389	60.415	19.646	63.113	19.961	65.841	20.331	68.600	20.758	71.387	21.240	74.201	21.776	77.040	22.368	79.902	23.013	82.787	23.711	85.692	24.462	88.616	25.264	50	40 (H)**
45	50.394	17.324	53.038	17.547	55.719	17.833	58.436	18.181	61.186	18.592	63.968	19.065	66.781	19.599	69.621	20.193	72.487	20.847	75.376	21.560	78.290	22.331	81.223	23.158	84.174	24.042	45	35 (P)*
40	45.672	15.467	48.332	15.717	51.034	16.038	53.774	16.430	56.550	16.891	59.361	17.421	62.203	18.019	65.074	18.684	67.971	19.415	70.893	20.211	73.836	21.070	76.797	21.991	79.775	22.973	40	35 (H) 30 (P)*
35	40.956	13.620	43.637	13.906	46.364	14.272	49.132	14.718	51.941	15.244	54.785	15.846	57.662	16.526	60.568	17.280	63.500	18.107	66.456	19.007	69.430	19.975	72.421	21.012	75.424	22.113	35	
33	39.072	12.885	41.763	13.188	44.501	13.576	47.284	14.049	50.106	14.605	52.966	15.243	55.858	15.961	58.780	16.757	61.727	17.631	64.696	18.578	67.683	19.598	70.684	20.688	73.696	21.846	33	
30	36.249	11.788	38.957	12.121	41.716	12.547	44.520	13.066	47.367	13.675	50.252	14.373	53.170	15.158	56.116	16.028	59.086	16.979	62.075	18.010	65.079	19.117	68.093	20.297	71.112	21.547	30	30 (H)**
25	31.556	9.980	34.300	10.379	37.100	10.888	39.951	11.506	42.846	12.231	45.778	13.058	48.742	13.985	51.729	15.008	54.734	16.123	57.750	17.324	60.770	18.607	63.787	19.967	66.796	21.399	25	
23	29.685	9.268	32.447	9.700	35.267	10.252	38.140	10.922	41.057	11.705	44.010	12.598	46.992	13.596	49.994	14.694	53.009	15.888	56.029	17.172	59.046	18.538	62.052	19.981			23	25 (P)*
20	26.887	8.215	29.680	8.711	32.517	9.342	35.446	10.106	38.399	10.996	41.383	12.007	44.390	13.132	47.408	14.364	50.427	15.696	53.436	17.119							20	25 (H)**
15	22.260	6.533	25.126	7.187	28.058	8.014	31.038	9.005	34.046	10.148	37.066	11.431	40.077	12.839													15	20 (P)*
14	21.343	6.214	24.227	6.912	27.176	7.793	30.170	8.845	33.186	10.055	36.203	11.407															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 87 Degrees

TABLE 16 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Δ=87°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2412.510	946.643	2415.023	946.661	2417.537	946.682	2420.051	946.703	2422.566	946.725	2425.083	946.749	2427.599	946.773	2430.117	946.800	2432.635	946.826	2435.155	946.853	2437.675	946.884	2440.196	946.914	2442.717	946.946	2500	
2200	2127.834	833.083	2130.349	833.104	2132.865	833.127	2135.381	833.152	2137.899	833.177	2140.417	833.204	2142.936	833.232	2145.456	833.261	2147.977	833.292	2150.499	833.324	2153.022	833.357	2155.545	833.392	2158.070	833.428	2200	
2000	1938.053	757.380	1940.569	757.404	1943.086	757.429	1945.604	757.456	1948.124	757.484	1950.644	757.513	1953.165	757.544	1955.687	757.576	1958.210	757.610	1960.734	757.645	1963.259	757.682	1965.785	757.720	1968.312	757.759	2000	
1800	1748.274	681.681	1750.792	681.707	1753.312	681.735	1755.832	681.765	1758.353	681.796	1760.875	681.829	1763.398	681.863	1765.923	681.899	1768.448	681.936	1770.975	681.975	1773.503	682.016	1776.032	682.058	1778.562	682.102	1800	
1500	1463.613	568.142	1466.135	568.174	1468.658	568.208	1471.182	568.243	1473.707	568.280	1476.234	568.319	1478.762	568.361	1481.291	568.404	1483.822	568.449	1486.354	568.496	1488.887	568.544	1491.421	568.595	1493.957	568.648	1500	
1200	1178.966	454.624	1181.493	454.664	1184.021	454.706	1186.551	454.750	1189.083	454.796	1191.616	454.846	1194.151	454.897	1196.688	454.951	1199.226	455.007	1201.765	455.066	1204.307	455.127	1206.850	455.190	1209.394	455.256	1200	
1000	989.214	378.966	991.747	379.013	994.281	379.063	996.817	379.116	999.355	379.173	1001.895	379.231	1004.436	379.293	1006.980	379.358	1009.526	379.425	1012.073	379.496	1014.623	379.569	1017.174	379.645	1019.727	379.724	1000	
900	894.346	341.147	896.881	341.199	899.419	341.255	901.959	341.314	904.501	341.376	907.046	341.442	909.592	341.510	912.140	341.582	914.691	341.657	917.243	341.735	919.798	341.817	922.355	341.901	924.914	341.989	900	
800	799.484	303.338	802.024	303.397	804.567	303.460	807.111	303.526	809.658	303.596	812.208	303.670	814.760	303.747	817.314	303.828	819.871	303.912	822.430	304.000	824.991	304.092	827.555	304.187	830.122	304.285	800	
700	704.632	265.544	707.177	265.612	709.726	265.684	712.277	265.759	714.831	265.839	717.387	265.923	719.947	266.011	722.509	266.104	725.073	266.200	727.640	266.300	730.210	266.405	732.783	266.514	735.358	266.626	700	
600	609.794	227.771	612.347	227.851	614.903	227.934	617.463	228.023	620.026	228.116	622.591	228.214	625.160	228.317	627.732	228.425	630.307	228.537	632.885	228.654	635.466	228.776	638.050	228.903	640.637	229.034	600	
500	514.979	190.034	517.543	190.129	520.110	190.229	522.681	190.336	525.256	190.448	527.834	190.565	530.416	190.688	533.002	190.818	535.591	190.953	538.184	191.093	540.781	191.240	543.381	191.392	545.985	191.549	500	
400	420.205	152.358	422.783	152.476	425.367	152.602	427.955	152.735	430.547	152.875	433.145	153.021	435.746	153.176	438.352	153.337	440.963	153.506	443.578	153.681	446.197	153.864	448.821	154.054	451.450	154.251	400	
360	382.313	137.316	384.900	137.448	387.493	137.587	390.090	137.735	392.692	137.890	395.300	138.053	397.912	138.225	400.529	138.404	403.152	138.591	405.778	138.786	408.410	138.989	411.047	139.200	413.688	139.418	360	100 (P)*
350	372.843	133.559	375.432	133.694	378.027	133.838	380.627	133.990	383.232	134.149	385.843	134.317	388.458	134.493	391.078	134.678	393.703	134.870	396.334	135.071	398.969	135.280	401.610	135.496	404.255	135.722	350	
300	325.509	114.804	328.112	114.962	330.722	115.129	333.338	115.306	335.959	115.492	338.587	115.688	341.220	115.893	343.860	116.108	346.504	116.333	349.155	116.567	351.811	116.810	354.473	117.063	357.140	117.325	300	
250	278.218	96.119	280.842	96.308	283.472	96.509	286.109	96.720	288.754	96.944	291.405	97.179	294.063	97.425	296.727	97.682	299.399	97.951	302.077	98.232	304.761	98.523	307.452	98.826	310.150	99.140	250	
240	259.320	88.674	261.954	88.880	264.595	89.098	267.243	89.328	269.899	89.571	272.563	89.826	275.233	90.093	277.911	90.373	280.595	90.665	283.287	90.969	285.986	91.286	288.692	91.615	291.405	91.957	230	80 (P)*
200	231.003	77.355	233.655	77.791	236.315	78.042	238.984	78.306	241.661	78.585	244.347	78.878	247.040	79.186	249.742	79.507	252.451	79.842	255.168	80.192	257.893	80.555	260.626	80.933	263.366	81.324	200	
170	202.736	66.520	205.412	66.798	208.098	67.092	210.794	67.403	213.499	67.730	216.213	68.074	218.936	68.435	221.669	68.812	224.410	69.206	227.160	69.616	229.919	70.042	232.686	70.485	235.461	70.944	170	
155	188.629	61.049	191.321	61.353	194.023	61.675	196.736	62.016	199.458	62.375	202.190	62.752	204.932	63.147	207.684	63.560	210.445	63.991	213.215	64.440	215.994	64.907	218.783	65.391	221.580	65.894	155	65 (P)*
125	160.501	50.255	163.233	50.631	165.977	51.030	168.733	51.451	171.500	51.894	174.279	52.359	177.069	52.847	179.869	53.356	182.680	53.888	185.502	54.441	188.333	55.016	191.175	55.613	194.026	56.231	125	
100	137.200	41.515	139.980	41.983	142.774	42.479	145.581	43.002	148.401	43.553	151.234	44.131	154.079	44.736	156.936	45.367	159.805	46.026	162.684	46.713	165.574	47.422	168.474	48.160	171.384	48.923	100	
90	127.937	38.130	130.742	38.649	133.561	39.198	136.395	39.777	139.242	40.386	142.102	41.026	144.975	41.694	147.859	42.393	150.756	43.120	153.663	43.876	156.581	44.661	159.509	45.475	162.446	46.317	90	50 (P)
80	118.721	34.842	121.556	35.424	124.405	36.039	127.269	36.689	130.147	37.369	133.038	38.083	135.942	38.831	138.858	39.610	141.785	40.422	144.723	41.266	147.671	42.140	150.629	43.046	153.595	43.982	80	50 (H)**
70	109.569	31.693	112.438	32.353	115.323	33.051	118.222	33.787	121.136	34.560	124.062	35.369	127.001	36.215	129.951	37.096	132.912	38.013	135.882	38.965	138.861	39.951	141.848	40.970	144.842	42.023	70	
60	100.504	28.747	103.414	29.510	106.339	30.317	109.279	31.165	112.231	32.056	115.196	32.987	118.172	33.958	121.157	34.970	124.150	36.020	127.151	37.108	130.158	38.234	133.170	39.396	136.186	40.594	60	40 (P)*
55	96.013	27.382	98.946	28.210	101.893	29.083	104.854	30.001	107.827	30.964	110.811	31.970	113.804	33.018	116.806	34.108	119.813	35.239	122.826	36.409	125.843	37.618	128.862	38.865	131.882	40.149	55	
50	91.557	26.117	94.513	27.019	97.484	27.971	100.466	28.970	103.459	30.017	106.460	31.109	109.469	32.245	112.482	33.425	115.500	34.648	118.520	35.911	121.540	37.214	124.559	38.556	127.575	39.935	50	40 (H)**
45	87.140	24.980	90.120	25.971	93.113	27.015	96.115	28.109	99.124	29.253	102.139	30.445	105.158	31.684	108.178	32.967	111.197	34.294	114.214	35.663	117.226	37.071	120.232	38.518	123.229	40.001	45	35 (P)*
40	82.767	24.013	85.769	25.111	88.780	26.264	91.796	27.471	94.816	28.729	97.836	30.037	100.854	31.393	103.867	32.794	106.873	34.238	109.869	35.724							40	30 (H)**
35	78.436	23.278	81.454	24.503	84.474	25.787	87.493	27.126	90.507	28.517	93.514	29.958															35	
33	76.713	23.067	79.733	24.351	82.752	25.693	85.765	27.090	88.770	28.541																	33	30 (P)*
30	74.132	22.863	77.147	24.241	80.155	25.679																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 88 Degrees

$\Delta = 88°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	2421.723	975.411	2424.226	975.415	2426.729	975.421	2429.234	975.427	2431.739	975.433	2434.245	975.443	2436.752	975.453	2439.260	975.464	2441.768	975.476	2444.277	975.490	2446.787	975.504	2449.298	975.520	2451.810	975.536	2500	
2200	2132.047	858.363	2134.520	858.368	2137.024	858.374	2139.530	858.381	2142.035	858.390	2144.542	858.399	2147.050	858.411	2149.559	858.423	2152.068	858.437	2154.579	858.452	2157.090	858.469	2159.602	858.486	2162.116	858.505	2200	
2000	1938.880	780.331	1941.384	780.336	1943.888	780.343	1946.394	780.351	1948.900	780.361	1951.408	780.371	1953.916	780.384	1956.426	780.397	1958.936	780.413	1961.448	780.429	1963.960	780.448	1966.474	780.467	1968.988	780.488	2000	
1800	1745.743	702.300	1748.247	702.305	1750.752	702.312	1753.258	702.321	1755.765	702.332	1758.274	702.344	1760.783	702.358	1763.294	702.373	1765.805	702.390	1768.318	702.408	1770.832	702.428	1773.347	702.450	1775.863	702.473	1800	
1600	1456.038	585.252	1458.542	585.259	1461.048	585.268	1463.556	585.278	1466.064	585.291	1468.574	585.305	1471.086	585.322	1473.598	585.340	1476.113	585.360	1478.628	585.381	1481.145	585.407	1483.662	585.433	1486.182	585.461	1600	
1400	1166.333	468.206	1168.839	468.214	1171.346	468.225	1173.855	468.239	1176.366	468.254	1178.879	468.272	1181.393	468.293	1183.909	468.316	1186.426	468.341	1188.945	468.369	1191.466	468.399	1193.989	468.432	1196.513	468.467	1400	
1200	973.197	390.175	975.704	390.186	978.213	390.199	980.724	390.215	983.237	390.233	985.752	390.255	988.269	390.280	990.788	390.307	993.309	390.338	995.832	390.371	998.356	390.407	1000.883	390.446	1003.412	390.488	1200	
1000	876.629	351.161	879.137	351.172	881.647	351.187	884.159	351.204	886.673	351.225	889.190	351.249	891.709	351.277	894.230	351.307	896.754	351.341	899.279	351.378	901.806	351.418	904.336	351.461	906.868	351.508	1000	
900	780.062	312.146	782.570	312.159	785.082	312.175	787.595	312.195	790.112	312.219	792.630	312.246	795.152	312.277	797.675	312.311	800.201	312.349	802.730	312.391	805.261	312.436	807.794	312.485	810.330	312.537	900	
800	683.494	273.132	686.005	273.147	688.517	273.165	691.033	273.188	693.552	273.215	696.073	273.246	698.597	273.281	701.124	273.320	703.654	273.364	706.187	273.412	708.722	273.463	711.260	273.519	713.801	273.579	800	100 (P)*
700	586.928	234.119	589.439	234.136	591.954	234.158	594.473	234.184	596.994	234.216	599.519	234.252	602.047	234.293	604.579	234.339	607.114	234.389	609.652	234.445	612.193	234.505	614.737	234.571	617.285	234.641	700	
600	490.362	195.107	492.876	195.128	495.394	195.154	497.916	195.186	500.442	195.223	502.972	195.267	505.505	195.316	508.043	195.371	510.584	195.431	513.130	195.498	515.679	195.571	518.232	195.649	520.790	195.733	600	
500	393.798	156.098	396.315	156.123	398.838	156.156	401.365	156.195	403.897	156.242	406.434	156.297	408.976	156.358	411.523	156.427	414.075	156.503	416.632	156.586	419.193	156.677	421.759	156.774	424.330	156.879	500	
450	353.173	140.495	357.692	140.523	360.217	140.559	362.747	140.604	365.283	140.656	367.824	140.716	370.371	140.784	372.923	140.861	375.480	140.945	378.043	141.038	380.611	141.138	383.184	141.247	385.762	141.363	450	
400	345.517	136.594	348.036	136.623	350.562	136.660	353.093	136.706	355.630	136.760	358.172	136.822	360.720	136.892	363.274	136.971	365.833	137.057	368.397	137.153	370.967	137.256	373.542	137.367	376.123	137.488	400	80 (P)*
350	297.236	117.092	299.760	117.126	302.290	117.170	304.826	117.222	307.369	117.285	309.918	117.358	312.474	117.440	315.036	117.531	317.604	117.633	320.179	117.743	322.760	117.864	325.347	117.994	327.941	118.134	350	
300	248.958	97.593	251.486	97.633	254.021	97.685	256.565	97.749	259.116	97.824	261.675	97.911	264.242	98.010	266.816	98.120	269.397	98.241	271.987	98.374	274.583	98.519	277.187	98.675	279.798	98.843	300	
250	229.647	89.794	232.178	89.838	234.716	89.895	237.263	89.964	239.819	90.046	242.383	90.140	244.955	90.247	247.536	90.367	250.124	90.499	252.721	90.644	255.325	90.801	257.938	90.970	260.558	91.153	250	
230	200.682	78.098	203.217	78.148	205.762	78.213	208.316	78.293	210.879	78.387	213.453	78.496	216.035	78.619	218.627	78.756	221.228	78.908	223.839	79.074	226.458	79.255	229.087	79.450	231.724	79.660	230	
210	171.720	66.404	174.260	66.464	176.813	66.541	179.376	66.634	181.951	66.745	184.536	66.873	187.133	67.017	189.740	67.179	192.358	67.357	194.987	67.553	197.626	67.765	200.276	67.995	202.935	68.241	210	65 (P)*
195	157.239	60.559	159.784	60.625	162.341	60.709	164.910	60.811	167.492	60.933	170.086	61.073	172.691	61.231	175.308	61.409	177.937	61.604	180.577	61.819	183.229	62.052	185.892	62.303	188.566	62.573	195	
185	138.282	48.875	140.838	48.956	143.408	49.060	145.993	49.187	148.594	49.338	151.208	49.511	153.838	49.708	156.481	49.927	159.139	50.170	161.810	50.435	164.495	50.723	167.193	51.035	169.904*	51.368	185	
175	104.158	39.147	106.726	39.248	109.314	39.378	111.919	39.537	114.543	39.725	117.185	39.942	119.844	40.187	122.520	40.461	125.213	40.764	127.923	41.095	130.648	41.454	133.389	41.842	136.146	42.258	175	
165	94.511	35.259	97.087	35.372	99.683	35.517	102.300	35.693	104.937	35.902	107.593	36.143	110.268	36.415	112.962	36.719	115.674	37.055	118.404	37.422	121.151	37.821	123.915	38.251	126.695	38.712	165	50 (P)*
155	84.866	31.376	87.451	31.502	90.059	31.665	92.690	31.864	95.342	32.098	98.016	32.369	100.711	32.675	103.427	33.017	106.162	33.394	108.917	33.807	111.690	34.254	114.481	34.737	117.289	35.254	155	
145	75.223	27.497	77.821	27.642	80.444	27.828	83.092	28.055	85.764	28.323	88.461	28.631	91.181	28.981	93.923	29.371	96.687	29.801	99.471	30.271	102.276	30.781	105.100	31.330	107.943	31.919	145	
135	65.588	23.627	68.200	23.796	70.842	24.012	73.512	24.277	76.211	24.589	78.936	24.948	81.687	25.355	84.463	25.808	87.263	26.308	90.086	26.854	92.930	27.446	95.794	28.083	98.678	28.763	135	
125	60.773	21.696	63.394	21.880	66.048	22.116	68.732	22.404	71.447	22.744	74.190	23.136	76.961	23.579	79.757	24.072	82.579	24.616	85.424	25.210	88.291	25.853	91.179	26.545	94.087	27.286	125	
115	55.960	19.769	58.592	19.971	61.260	20.221	63.961	20.547	66.695	20.921	69.458	21.351	72.251	21.837	75.071	22.379	77.918	22.975	80.788	23.625	83.681	24.329	86.595	25.086	89.529	25.893	115	
105	51.150	17.847	53.797	18.071	56.481	18.360	59.202	18.711	61.958	19.126	64.746	19.602	67.564	20.141	70.412	20.740	73.286	21.400	76.185	22.118	79.107	22.895	82.050	23.730	85.011	24.621	105	35 (P)*
95	46.345	15.932	49.004	16.184	51.713	16.508	54.458	16.903	57.240	17.368	60.057	17.903	62.906	18.506	65.786	19.177	68.695	19.914	71.633	20.716	74.577	21.582	77.549	22.511	80.539	23.501	95	35 (H) 30 (P)*
85	41.546	14.027	44.230	14.316	46.961	14.685	49.736	15.135	52.550	15.665	55.401	16.273	58.287	16.958	61.202	17.719	64.145	18.553	67.111	19.460	70.097	20.436	73.100	21.481	76.117	22.592	85	
75	36.756	12.138	39.468	12.474	42.232	12.904	45.043	13.427	47.897	14.042	50.790	14.746	53.717	15.537	56.674	16.414	59.656	17.373	62.658	18.413	65.675	19.529	68.703	20.719	71.737	21.979	75	30 (H)**
65	31.967	10.247	34.729	10.676	37.536	11.189	40.394	11.813	43.298	12.543	46.240	13.378	49.215	14.312	52.215	15.344	55.233	16.468	58.264	17.679	61.299	18.973	64.333	20.345	67.358	21.788	65	
55	30.076	9.538	32.843	9.974	35.671	10.531	38.551	11.206	41.478	11.996	44.442	12.896	47.436	13.903	50.452	15.011	53.481	16.215	56.516	17.509	59.550	18.887	62.573	20.342			55	
50	27.229	8.452	30.029	8.951	32.893	9.588	35.812	10.358	38.775	11.256	41.772	12.275	44.792	13.410	47.825	14.653	50.860	15.996	53.887	17.430							50	25 (H)**
45	22.521	6.714	25.395	7.373	28.337	8.207	31.329	9.206	34.351	10.359	37.386	11.653	40.415	13.073													45	20 (P)*
40	21.589	6.384	24.481	7.087	27.441	7.976	30.447	9.037	33.477	10.257	36.511	11.620															40	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 88 Degrees

$\Delta = 88°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2454.322	975.554	2456.835	975.573	2459.349	975.594	2461.864	975.615	2464.380	975.638	2466.896	975.662	2469.413	975.687	2471.931	975.713	2474.450	975.740	2476.970	975.768	2479.490	975.798	2482.011	975.828	2484.533	975.860	2500	
2200	2164.629	858.526	2167.145	858.548	2169.660	858.571	2172.177	858.595	2174.695	858.621	2177.214	858.648	2179.733	858.676	2182.254	858.706	2184.775	858.737	2187.297	858.769	2189.820	858.802	2192.344	858.837	2194.869	858.873	2200	
2000	1971.504	780.510	1974.020	780.534	1976.538	780.560	1979.056	780.586	1981.576	780.615	1984.096	780.644	1986.618	780.676	1989.140	780.708	1991.664	780.742	1994.188	780.777	1996.713	780.814	1999.240	780.853	2001.767	780.892	2000	
1800	1778.380	702.499	1780.899	702.525	1783.418	702.553	1785.939	702.583	1788.460	702.614	1790.983	702.647	1793.507	702.682	1796.032	702.718	1798.558	702.756	1801.085	702.795	1803.613	702.836	1806.142	702.879	1808.673	702.923	1800	
1500	1488.702	585.491	1491.224	585.523	1493.748	585.557	1496.272	585.592	1498.798	585.630	1501.325	585.669	1503.854	585.711	1506.384	585.754	1508.915	585.800	1511.447	585.847	1513.981	585.896	1516.516	585.947	1519.052	586.000	1500	
1200	1199.038	468.504	1201.566	468.544	1204.095	468.586	1206.625	468.630	1209.158	468.677	1211.692	468.727	1214.227	468.779	1216.764	468.833	1219.303	468.890	1221.844	468.949	1224.385	469.010	1226.929	469.075	1229.475	469.141	1200	
1000	1005.943	390.533	1008.476	390.581	1011.011	390.632	1013.547	390.685	1016.086	390.742	1018.626	390.801	1021.169	390.863	1023.714	390.928	1026.260	390.996	1028.808	391.067	1031.359	391.141	1033.911	391.218	1036.465	391.297	1000	
900	909.403	351.558	911.939	351.611	914.478	351.667	917.018	351.727	919.561	351.790	922.106	351.855	924.653	351.925	927.202	351.997	929.754	352.073	932.307	352.152	934.863	352.234	937.421	352.319	939.981	352.407	900	
800	812.869	312.593	815.410	312.653	817.953	312.717	820.499	312.783	823.046	312.854	825.597	312.928	828.150	313.006	830.705	313.087	833.263	313.172	835.823	313.261	838.385	313.353	840.950	313.449	843.518	313.549	800	
700	716.345	275.643	718.891	275.711	721.441	275.784	723.993	275.860	726.548	275.941	729.105	276.026	731.666	274.115	734.229	274.208	736.794	274.305	739.363	274.406	741.934	274.512	744.508	274.621	747.084	274.735	700	
600	619.836	234.715	622.390	234.795	624.947	234.879	627.508	234.969	630.072	235.063	632.638	235.161	635.208	235.265	637.782	235.374	640.358	235.487	642.937	235.605	645.520	235.728	648.106	235.856	650.695	235.989	600	
500	523.350	195.823	525.915	195.918	528.483	196.019	531.056	196.126	533.632	196.239	536.211	196.358	538.795	196.482	541.382	196.613	543.973	196.749	546.568	196.890	549.167	197.038	551.769	197.191	554.374	197.350	500	
400	426.905	156.991	429.486	157.111	432.070	157.237	434.660	157.371	437.254	157.512	439.854	157.660	442.457	157.816	445.065	157.979	447.677	158.148	450.295	158.326	452.917	158.510	455.542	158.701	458.173	158.900	400	
360	388.346	140.488	390.935	141.620	393.529	141.761	396.128	141.910	398.732	142.066	401.342	142.231	403.956	142.404	406.576	142.584	409.200	142.773	411.829	142.970	414.464	143.175	417.103	143.387	419.747	143.608	360	100 (P)*
350	378.709	137.615	381.300	137.732	383.897	137.896	386.499	138.050	389.106	138.211	391.718	138.380	394.335	138.558	396.958	138.744	399.583	138.938	402.219	139.140	404.857	139.350	407.500	139.569	410.147	139.796	350	
300	330.541	118.284	333.146	118.443	335.758	118.611	338.376	118.790	341.000	118.978	343.630	119.175	346.266	119.382	348.907	119.599	351.555	119.825	354.208	120.061	356.868	120.306	359.532	120.561	362.203	120.826	300	
250	282.417	99.022	285.043	99.213	287.676	99.415	290.315	99.629	292.963	99.854	295.616	100.091	298.277	100.339	300.945	100.599	303.620	100.870	306.301	101.153	308.989	101.447	311.684	101.752	314.385	102.069	250	
230	263.186	91.347	265.822	91.555	268.466	91.774	271.117	92.007	273.776	92.251	276.442	92.509	279.116	92.778	281.797	93.061	284.485	93.355	287.181	93.662	289.884	93.981	292.594	94.313	295.310	94.657	230	80 (P)*
200	234.370	79.883	237.025	80.122	239.688	80.374	242.360	80.641	245.041	80.922	247.730	81.218	250.427	81.527	253.132	81.851	255.846	82.190	258.567	82.542	261.297	82.909	264.034	83.289	266.779	83.684	200	
170	205.605	68.504	208.265	68.784	210.974	69.081	213.674	69.394	216.383	69.724	219.101	70.071	221.829	70.435	224.566	70.815	227.312	71.212	230.067	71.626	232.831	72.056	235.603	72.503	238.384	72.966	170	
155	191.250	62.864	193.946	63.168	196.652	63.493	199.368	63.837	202.095	64.198	204.832	64.578	207.579	64.977	210.335	65.393	213.101	65 8..8	215.877	66.280	218.662	66.751	221.456	67.240	224.260	67.747	155	65 (P)*
125	162.627	51.725	165.364	52.105	168.113	52.506	170.873	52.931	173.646	53.378	176.430	53.847	179.226	54.339	182.032	54.853	184.850	55.388	187.679	55.946	190.517	56.526	193.366	57.128	196.225	57.752	125	
100	138.917	42.702	141.703	43.174	144.502	43.674	147.316	44.202	150.143	44.757	152.983	45.340	155.835	45.950	158.700	46.587	161.576	47.251	164.464	47.942	167.362	48.659	170.271	49.403	173.191	50.173	100	
90	129.491	36.205	132.302	39.728	135.129	40.281	137.969	40.866	140.824	41.480	143.692	42.125	146.572	42.799	149.466	43.503	152.371	44.237	155.287	44.999	158.214	45.791	161.152	46.611	164.100	47.460	90	50 (P)
80	120.114	33.606	122.956	36.392	125.813	37.012	128.685	37.666	131.571	38.353	134.471	39.074	137.384	39.827	140.309	40.614	143.246	41.432	146.194	42.283	149.153	43.165	152.121	44.078	155.099	45.022	80	50 (H)**
70	110.803	32.546	113.680	33.212	116.573	33.916	119.482	34.658	122.404	35.437	125.341	36.253	128.289	37.106	131.250	37.995	134.222	38.919	137.204	39.879	140.195	40.873	143.194	41.901	146.201	42.963	70	
60	101.380	29.491	104.500	30.261	107.435	31.074	110.385	31.930	113.348	32.828	116.324	33.767	119.311	34.747	122.309	35.766	125.315	36.825	128.329	37.923	131.350	39.058	134.376	40.230	137.406	41.438	60	40 (P)*
55	97.013	28.073	99.935	28.908	102.913	29.788	105.885	30.714	108.870	31.685	111.866	32.699	114.872	33.757	117.887	34.856	120.908	35.996	123.935	37.176	126.966	38.395	130.000	39.653	133.036	40.947	55	
50	92.480	26.755	95.448	27.665	98.429	28.625	101.424	29.633	104.429	30.688	107.444	31.789	110.466	32.935	113.495	34.125	116.527	35.358	119.562	36.632	122.598	37.946	125.633	39.299	128.666	40.689	50	40 (H)**
45	87.989	25.567	90.981	26.567	93.986	27.619	97.002	28.723	100.025	29.876	103.054	31.078	106.088	32.327	109.124	33.621	112.159	34.959	115.193	36.339	118.222	37.760	121.245	39.219	124.260	40.714	45	35 (P)*
40	83.543	24.550	86.539	25.627	89.544	26.820	92.615	28.032	95.650	29.306	98.685	30.624	101.720	31.992	104.750	33.404	107.774	34.861	110.788	36.359							40	30 (H)**
35	79.143	23.767	82.176	25.002	85.211	26.297	88.246	27.647	91.278	29.050	94.302	30.503															35	
33	77.393	23.538	80.429	24.832	83.464	26.185	86.494	27.594	89.517	29.057																	33	30 (P)*
30	74.773	23.306	77.805	24.696	80.830	26.146																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 89 Degrees **$\Delta = 89°$**

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	2464.244	1005.083	2466.747	1005.087	2469.251	1005.092	2471.755	1005.098	2474.261	1005.106	2476.767	1005.115	2479.274	1005.125	2481.781	1005.136	2484.290	1005.148	2486.799	1005.162	2489.309	1005.176	2491.821	1005.192	2494.333	1005.209	2500	
2200	2169.436	884.474	2171.939	884.479	2174.443	884.485	2176.948	884.492	2179.455	884.500	2181.961	884.510	2184.469	884.522	2186.978	884.534	2189.488	884.549	2191.998	884.563	2194.510	884.580	2197.023	884.598	2199.536	884.617	2200	
2000	1972.897	804.068	1975.401	804.073	1977.905	804.080	1980.411	804.088	1982.918	804.098	1985.425	804.109	1987.934	804.121	1990.444	804.135	1992.954	804.150	1995.466	804.167	1997.979	804.186	2000.492	804.205	2003.007	804.226	2000	
1800	1776.358	723.663	1778.862	723.669	1781.367	723.676	1783.874	723.685	1786.381	723.695	1788.890	723.708	1791.399	723.721	1793.910	723.737	1796.422	723.754	1798.935	723.772	1801.449	723.793	1803.964	723.815	1806.481	723.838	1800	
1600	1481.351	603.055	1484.055	603.062	1486.561	603.071	1489.069	603.081	1491.578	603.094	1494.088	603.109	1496.599	603.125	1499.112	603.144	1501.627	603.164	1504.142	603.187	1506.659	603.211	1509.177	603.237	1511.697	603.265	1500	
1200	1186.743	482.444	1189.249	482.457	1191.757	482.468	1194.266	482.481	1196.777	482.497	1199.290	482.515	1201.804	482.536	1204.321	482.559	1206.838	482.584	1209.358	482.612	1211.879	482.643	1214.402	482.676	1216.926	482.711	1200	
1000	990.203	402.044	992.713	402.054	995.222	402.068	997.733	402.084	1000.246	402.103	1002.761	402.125	1005.279	402.149	1007.798	402.177	1010.319	402.208	1012.843	402.241	1015.368	402.278	1017.895	402.317	1020.425	402.360	1000	
900	891.937	361.843	894.445	361.854	896.955	361.869	899.467	361.886	901.982	361.907	904.499	361.932	907.018	361.959	909.540	361.990	912.063	362.024	914.589	362.062	917.117	362.102	919.648	362.146	922.180	362.193	900	
800	793.668	321.641	796.177	321.654	798.689	321.670	801.203	321.690	803.719	321.714	806.238	321.741	808.760	321.773	811.284	321.807	813.811	321.845	816.340	321.888	818.871	321.933	821.406	321.982	823.942	322.035	800	
700	695.401	281.440	697.911	281.455	700.424	281.474	702.940	281.497	705.459	281.524	707.980	281.555	710.505	281.591	713.032	281.630	715.563	281.674	718.096	281.722	720.632	281.774	723.171	281.831	725.713	281.891	700	100 (P)*
600	597.133	241.240	599.645	241.258	602.160	241.280	604.679	241.306	607.201	241.338	609.726	241.374	612.255	241.416	614.787	241.462	617.322	241.513	619.861	241.569	622.403	241.630	624.948	241.696	627.497	241.766	600	
500	498.867	201.042	501.381	201.062	503.899	201.088	506.421	201.121	508.948	201.158	511.478	201.202	514.012	201.252	516.551	201.307	519.093	201.369	521.639	201.436	524.189	201.509	526.744	201.588	529.302	201.673	500	
400	400.602	160.845	403.119	160.871	405.642	160.904	408.170	160.944	410.703	160.991	413.241	161.046	415.783	161.106	418.331	161.177	420.884	161.254	423.441	161.338	426.004	161.429	428.571	161.528	431.143	161.634	400	
360	361.296	144.768	363.816	144.796	366.341	144.833	368.872	144.877	371.409	144.930	373.950	144.990	376.498	145.060	379.051	145.137	381.609	145.222	384.173	145.315	386.742	145.417	389.317	145.526	391.896	145.644	360	
300	351.470	140.749	353.990	140.778	356.516	140.815	359.048	140.861	361.585	140.915	364.129	140.978	366.677	141.049	369.232	141.128	371.792	141.216	374.357	141.312	376.929	141.416	379.505	141.528	382.087	141.649	360	80 (P)*
280	302.139	120.653	304.863	120.687	307.394	120.731	309.930	120.784	312.474	120.848	315.024	120.921	317.581	121.004	320.144	121.096	322.714	121.198	325.290	121.310	327.873	121.432	330.461	121.563	333.057	121.704	300	
250	253.211	100.560	255.739	100.601	258.275	100.654	260.820	100.718	263.372	100.794	265.932	100.882	268.500	100.981	271.075	101.092	273.658	101.214	276.249	101.349	278.847	101.494	281.453	101.652	284.066	101.821	250	
230	233.560	92.524	236.091	92.569	238.630	92.626	241.178	92.696	243.733	92.778	246.300	92.873	248.873	92.981	251.455	93.102	254.045	93.235	256.644	93.381	259.250	93.540	261.865	93.711	264.487	93.895	230	
200	204.085	80.472	206.620	80.523	209.166	80.589	211.721	80.669	214.286	80.764	216.860	80.873	219.444	80.997	222.038	81.136	224.641	81.289	227.253	81.457	229.875	81.639	232.506	81.836	235.146	82.047	200	
170	174.612	68.423	177.154	68.483	179.707	68.560	182.271	68.654	184.847	68.766	187.434	68.895	190.033	69.041	192.642	69.204	195.262	69.384	197.893	69.581	200.535	69.795	203.187	70.027	205.850	70.275	170	65 (P)*
155	159.877	62.400	162.422	62.466	164.980	62.550	167.551	62.654	170.134	62.776	172.729	62.917	175.337	63.077	177.956	63.256	180.587	63.454	183.230	63.670	185.885	63.905	188.551	64.158	191.228	64.430	155	
125	130.410	50.452	132.965	50.441	135.538	50.546	138.124	50.674	140.727	50.826	143.344	51.001	145.975	51.199	148.621	51.421	151.282	51.665	153.956	51.933	156.645	52.224	159.346	52.537	162.061	52.874	125	
100	105.860	40.335	108.430	40.432	111.019	40.568	113.627	40.728	116.253	40.918	118.897	41.136	121.559	41.384	124.239	41.660	126.936	41.965	129.649	42.299	132.379	42.662	135.125	43.053	137.886	43.473	100	
90	96.043	36.329	98.620	36.442	101.219	36.588	103.838	36.766	106.477	36.977	109.136	37.219	111.815	37.494	114.513	37.801	117.229	38.140	119.963	38.510	122.715	38.912	125.484	39.346	128.270	39.811	90	50 (P)*
80	86.229	32.327	88.815	32.454	91.425	32.618	94.058	32.819	96.714	33.055	99.391	33.328	102.090	33.637	104.810	33.982	107.549	34.362	110.309	34.778	113.087	35.230	115.884	35.716	118.699	36.238	80	50 (H)**
70	76.417	28.330	79.016	28.476	81.641	28.663	84.291	28.892	86.967	29.162	89.668	29.474	92.392	29.826	95.139	30.219	97.908	30.653	100.698	31.127	103.509	31.641	106.340	32.195	109.190	32.789	70	
60	66.611	24.341	69.225	24.511	71.870	24.729	74.543	24.996	77.246	25.311	79.975	25.674	82.732	26.084	85.513	26.541	88.319	27.045	91.148	27.596	94.000	28.193	96.872	28.835	99.764	29.523	60	40 (P)*
55	61.711	22.351	64.335	22.536	66.991	22.774	69.679	23.065	72.398	23.408	75.146	23.803	77.922	24.250	80.725	24.748	83.553	25.296	86.405	25.895	89.280	26.544	92.177	27.242	95.093	27.988	55	
50	56.813	20.364	59.449	20.568	62.112	20.820	64.825	21.150	67.562	21.527	70.331	21.960	73.130	22.450	75.957	22.997	78.810	23.598	81.689	24.254	84.591	24.964	87.514	25.727	90.458	26.543	50	40 (H)**
45	51.912	18.383	54.568	18.641	57.256	18.951	59.982	19.255	62.742	19.673	65.536	20.154	68.361	20.697	71.216	21.301	74.099	21.966	77.006	22.691	79.938	23.475	82.891	24.317	85.863	25.215	45	35 (P)*
40	47.029	16.409	49.696	16.664	52.402	16.991	55.154	17.389	57.942	17.858	60.766	18.397	63.622	19.005	66.510	19.682	69.425	20.425	72.366	21.234	75.330	22.108	78.314	23.045	81.316	24.043	40	35 (H) 30 (P)*
35	42.146	14.446	44.834	14.737	47.569	15.110	50.349	15.563	53.170	16.098	56.029	16.711	58.922	17.403	61.847	18.169	64.800	19.010	67.777	19.925	70.776	20.910	73.792	21.964	76.822	23.084	35	
33	40.195	13.665	42.893	13.973	45.641	14.368	48.435	14.849	51.271	15.414	54.146	16.063	57.056	16.793	59.997	17.603	62.966	18.491	65.958	19.455	68.970	20.492	71.998	21.601	75.038	22.778	33	
30	37.272	12.498	39.988	12.837	42.757	13.270	45.574	13.798	48.436	14.418	51.338	15.128	54.275	15.926	57.242	16.810	60.235	17.778	63.250	18.826	66.281	19.952	69.324	21.152	72.373	22.423	30	30 (H)**
25	32.412	10.575	35.166	10.980	37.979	11.498	40.844	12.127	43.757	12.864	46.710	13.705	49.696	14.648	52.708	15.686	55.741	16.822	58.786	18.043	61.837	19.348	64.888	20.732	67.931	22.188	25	
23	30.473	9.816	33.247	10.256	36.081	10.818	38.970	11.498	41.906	12.295	44.881	13.203	47.887	14.218	50.917	15.335	53.961	16.549	57.012	17.854	60.062	19.244	63.104	20.712			23	25 (P)*
20	27.577	8.695	30.383	9.199	33.235	9.841	36.183	10.617	39.157	11.522	42.167	12.553	45.201	13.695	48.249	14.949	51.300	16.303	54.365	17.750							20	25 (H)**
15	22.787	6.899	25.669	7.564	28.621	8.405	31.625	9.411	34.662	10.576	37.713	11.881	40.759	13.315													15	20 (P)*
14	21.828	6.558	24.739	7.267	27.710	8.163	30.729	9.234	33.774	10.464	36.825	11.839															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 89 Degrees

△=89°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	2496.845	1005.227	2499.358	1005.246	2501.873	1005.267	2504.388	1005.288	2506.904	1005.311	2509.420	1005.335	2511.938	1005.360	2514.456	1005.386	2516.975	1005.414	2519.495	1005.443	2522.016	1005.472	2524.537	1005.503	2527.060	1005.535	2500	
2200	2202.050	884.638	2204.566	884.660	2207.082	884.683	2209.599	884.708	2212.117	884.734	2214.636	884.761	2217.156	884.790	2219.677	884.819	2222.198	884.850	2224.721	884.883	2227.244	884.917	2229.769	884.952	2232.294	884.988	2200	
2000	2005.523	804.249	2008.040	804.273	2010.558	804.298	2013.076	804.325	2015.596	804.354	2018.117	804.384	2020.639	804.416	2023.162	804.448	2025.686	804.483	2028.210	804.518	2030.736	804.555	2033.263	804.594	2035.791	804.634	2000	
1800	1808.998	723.864	1811.517	723.890	1814.037	723.919	1816.558	723.949	1819.079	723.980	1821.603	724.013	1824.127	724.048	1826.652	724.085	1829.178	724.123	1831.706	724.163	1834.235	724.204	1836.765	724.247	1839.296	724.292	1800	
1500	1514.218	603.296	1516.740	603.328	1519.264	603.362	1521.789	603.398	1524.315	603.436	1526.843	603.476	1529.372	603.518	1531.903	603.562	1534.434	603.607	1536.967	603.655	1539.501	603.705	1542.037	603.756	1544.574	603.810	1500	
1200	1219.452	482.749	1221.980	482.789	1224.510	482.832	1227.041	482.876	1229.574	482.924	1232.108	482.974	1234.645	483.026	1237.182	483.081	1239.722	483.138	1242.263	483.198	1244.806	483.260	1247.350	483.324	1249.896	483.391	1200	
1000	1022.956	402.405	1025.490	402.453	1028.025	402.504	1030.562	402.558	1033.102	402.615	1035.643	402.675	1038.186	402.738	1040.731	402.803	1043.279	402.872	1045.828	402.944	1048.379	403.018	1050.932	403.095	1053.487	403.176	1000	
900	924.715	362.243	927.252	362.297	929.792	362.354	932.333	362.414	934.876	362.477	937.422	362.543	939.970	362.613	942.520	362.686	945.073	362.762	947.627	362.842	950.184	362.925	952.743	363.010	955.304	363.100	900	
800	826.481	322.092	829.023	322.152	831.567	322.216	834.113	322.284	836.662	322.355	839.214	322.430	841.768	322.508	844.324	322.590	846.883	322.676	849.444	322.766	852.007	322.858	854.573	322.955	857.142	323.055	800	
700	728.257	281.956	730.805	282.024	733.355	282.098	735.908	282.175	738.464	282.256	741.022	282.341	743.584	282.431	746.148	282.525	748.715	282.623	751.284	282.725	753.857	282.832	756.432	282.942	759.010	283.057	700	
600	630.049	241.842	632.604	241.922	635.162	242.007	637.724	242.097	640.289	242.192	642.856	242.292	645.428	242.396	648.002	242.506	650.580	242.620	653.161	242.739	655.745	242.863	658.333	242.992	660.923	243.126	600	
500	531.864	201.763	534.429	201.859	536.999	201.962	539.573	202.070	542.150	202.183	544.731	202.303	547.316	202.428	549.905	202.560	552.498	202.697	555.094	202.840	557.695	202.989	560.299	203.144	562.906	203.304	500	
400	433.720	161.747	436.302	161.867	438.888	161.995	441.480	162.130	444.075	162.272	446.676	162.421	449.281	162.578	451.892	162.743	454.506	162.914	457.126	163.092	459.750	163.278	462.378	163.471	465.011	163.672	400	
360	394.482	145.769	397.072	145.903	399.668	146.045	402.269	146.195	404.875	146.353	407.487	146.519	410.103	146.693	412.725	146.875	415.352	147.066	417.983	147.264	420.620	147.470	423.262	147.685	425.909	147.907	360	100 (P)*
350	384.675	141.778	387.268	141.916	389.866	142.062	392.470	142.216	395.079	142.379	397.693	142.550	400.313	142.729	402.938	142.916	405.568	143.112	408.203	143.316	410.844	143.528	413.490	143.749	416.140	143.978	350	
300	335.658	121.855	338.266	122.015	340.880	122.185	343.500	122.365	346.126	122.554	348.759	122.754	351.397	122.963	354.041	123.181	356.692	123.409	359.348	123.647	362.010	123.895	364.678	124.152	367.352	124.419	300	
250	286.687	102.002	289.315	102.194	291.951	102.398	294.593	102.614	297.243	102.841	299.900	103.080	302.564	103.330	305.235	103.592	307.913	103.866	310.597	104.151	313.289	104.447	315.988	104.755	318.693	105.075	250	
230	267.118	94.091	269.757	94.300	272.403	94.522	275.057	94.756	277.719	95.003	280.388	95.262	283.065	95.534	285.750	95.819	288.442	96.116	291.141	96.425	293.847	96.747	296.561	97.082	299.282	97.429	230	80 (P)*
200	237.794	82.273	240.452	82.513	243.119	82.768	245.794	83.037	248.478	83.321	251.170	83.619	253.871	83.931	256.581	84.258	259.298	84.599	262.024	84.954	264.758	85.324	267.500	85.708	270.250	86.106	200	
170	208.523	70.540	211.206	70.822	213.900	71.122	216.603	71.438	219.316	71.771	222.038	72.121	224.771	72.488	227.512	72.871	230.263	73.272	233.023	73.689	235.792	74.122	238.570	74.573	241.357	75.040	170	
155	193.916	64.721	196.615	65.031	199.325	65.358	202.046	65.705	204.777	66.070	207.518	66.453	210.270	66.855	213.032	67.275	215.803	67.713	218.584	68.170	221.375	68.644	224.175	69.137	226.985	69.648	155	65 (P)*
125	164.790	53.234	167.531	53.617	170.284	54.022	173.050	54.450	175.829	54.901	178.619	55.374	181.420	55.870	184.233	56.388	187.057	56.929	189.893	57.491	192.738	58.076	195.594	58.683	198.460	59.312	125	
100	140.663	43.921	143.454	44.397	146.260	44.901	149.080	45.433	151.914	45.993	154.761	46.581	157.621	47.196	160.493	47.838	163.378	48.508	166.274	49.205	169.181	49.928	172.099	50.678	175.028	51.455	100	
90	131.072	40.308	133.890	40.835	136.723	41.394	139.570	41.983	142.432	42.603	145.308	43.253	148.197	43.933	151.099	44.643	154.013	45.383	156.939	46.152	159.876	46.950	162.824	47.778	165.781	48.634	90	50 (P)
80	121.531	36.794	124.380	37.385	127.244	38.011	130.124	38.670	133.019	39.364	135.928	40.091	138.850	40.851	141.785	41.643	144.732	42.469	147.691	43.327	150.660	44.216	153.640	45.138	156.629	46.090	80	50 (H)**
70	112.058	33.421	114.943	34.093	117.845	34.803	120.762	35.551	123.694	36.337	126.641	37.160	129.600	38.020	132.571	38.917	135.554	39.849	138.548	40.817	141.551	41.819	144.563	42.856	147.583	43.927	70	
60	102.675	30.255	105.604	31.032	108.549	31.852	111.509	32.715	114.484	33.620	117.471	34.567	120.471	35.555	123.481	36.584	126.500	37.652	129.527	38.759	132.562	39.903	135.602	41.085	138.647	42.304	60	40 (P)*
55	98.029	28.782	100.982	29.624	103.951	30.512	106.934	31.446	109.931	32.425	112.939	33.448	115.958	34.514	118.986	35.623	122.021	36.773	125.063	37.963	128.109	39.193	131.159	40.461	134.210	41.766	55	
50	93.419	27.410	96.398	28.328	99.391	29.296	102.398	30.313	105.416	31.377	108.445	32.487	111.481	33.643	114.524	34.843	117.571	36.087	120.622	37.372	123.674	38.697	126.725	40.061	129.775	41.463	50	40 (H)**
45	88.852	26.169	91.857	27.178	94.875	28.239	97.904	29.352	100.941	30.516	103.985	31.728	107.034	32.987	110.086	34.293	113.138	35.642	116.188	37.034	119.235	38.466	122.276	39.938	125.309	41.446	45	35 (P)*
40	84.333	25.101	87.362	26.218	90.401	27.390	93.447	28.617	96.498	29.897	99.549	31.227	102.601	32.606	105.648	34.031	108.689	35.500	111.722	37.011							40	30 (H)**
35	79.862	24.269	82.910	25.515	85.961	26.820	89.013	28.181	92.061	29.597	95.103	31.063															35	
33	78.085	24.020	81.136	25.325	84.188	26.690	87.236	28.112	90.276	29.587																	33	30 (P)*
30	75.425	23.761	78.475	25.163	81.517	26.625																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

Δ=90°

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 90 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2507.500	1035.538	2510.003	1035.542	2512.507	1035.548	2515.012	1035.554	2517.517	1035.562	2520.023	1035.571	2522.531	1035.581	2525.039	1035.592	2527.547	1035.604	2530.057	1035.618	2532.567	1035.632	2535.078	1035.649	2537.590	1035.666	2500	
2200	2207.501	911.275	2210.005	911.280	2212.509	911.286	2215.014	911.293	2217.521	911.302	2220.028	911.312	2222.536	911.323	2225.045	911.336	2227.554	911.350	2230.065	911.365	2232.577	911.382	2235.090	911.400	2237.604	911.419	2200	
2000	2007.502	828.433	2010.006	828.438	2012.510	828.445	2015.016	828.453	2017.523	828.463	2020.031	828.474	2022.540	828.486	2025.050	828.500	2027.560	828.515	2030.072	828.532	2032.585	828.551	2035.099	828.571	2037.614	828.592	2000	
1800	1807.503	745.591	1810.007	745.597	1812.512	745.604	1815.019	745.613	1817.526	745.624	1820.035	745.636	1822.545	745.650	1825.055	745.666	1827.568	745.683	1830.081	745.701	1832.595	745.722	1835.111	745.744	1837.627	745.768	1800	
1500	1507.504	621.329	1510.009	621.336	1512.515	621.344	1515.023	621.355	1517.532	621.368	1520.042	621.383	1522.554	621.399	1525.067	621.418	1527.582	621.438	1530.098	621.461	1532.615	621.486	1535.134	621.512	1537.654	621.541	1500	
1200	1207.506	497.067	1210.012	497.075	1212.520	497.086	1215.030	497.100	1217.541	497.116	1220.054	497.135	1222.569	497.155	1225.085	497.179	1227.603	497.204	1230.123	497.233	1232.645	497.263	1235.168	497.296	1237.693	497.332	1200	
1000	1007.508	414.226	1010.015	414.237	1012.525	414.250	1015.036	414.266	1017.550	414.285	1020.065	414.307	1022.583	414.333	1025.103	414.361	1027.624	414.391	1030.148	414.425	1032.674	414.462	1035.201	414.502	1037.731	414.545	1000	
900	907.509	372.807	910.017	372.818	912.528	372.833	915.040	372.851	917.555	372.872	920.073	372.896	922.592	372.925	925.114	372.956	927.638	372.990	930.164	373.028	932.693	373.068	935.224	373.113	937.757	373.160	900	
800	807.511	331.387	810.020	331.400	812.531	331.417	815.046	331.437	817.563	331.461	820.082	331.488	823.604	331.520	825.128	331.555	827.656	331.593	830.185	331.636	832.717	331.682	835.252	331.731	837.789	331.785	800	
700	707.512	289.968	710.023	289.983	712.536	290.002	715.052	290.025	717.572	290.052	720.094	290.084	722.619	290.120	725.147	290.159	727.677	290.204	730.212	290.252	732.748	290.305	735.288	290.362	737.830	290.423	700	100 (P)*
600	607.515	248.550	610.027	248.567	612.542	248.589	615.062	248.616	617.584	248.648	620.110	248.685	622.639	248.727	625.171	248.773	627.707	248.825	630.247	248.881	632.790	248.943	635.336	249.009	637.885	249.080	600	
500	507.518	207.133	510.032	207.154	512.551	207.180	515.074	207.213	517.601	207.251	520.132	207.295	522.667	207.345	525.205	207.401	527.749	207.463	530.296	207.531	532.847	207.604	535.402	207.684	537.961	207.770	500	
400	407.521	163.719	410.041	163.744	412.564	163.777	415.093	163.818	417.626	163.866	420.165	163.921	422.708	163.984	425.257	164.054	427.810	164.131	430.369	164.216	432.932	164.307	435.501	164.407	438.074	164.514	400	
360	367.526	149.154	370.046	149.182	372.571	149.219	375.103	149.264	377.640	149.317	380.183	149.378	382.731	149.448	385.285	149.526	387.844	149.612	390.409	149.706	392.979	149.808	395.555	149.918	398.137	150.037	360	
320	327.526	143.013	360.047	145.042	362.572	145.080	365.106	145.126	367.644	145.181	370.188	145.244	372.737	145.315	375.293	145.396	377.854	145.484	380.421	145.581	382.993	145.686	385.571	145.799	388.155	145.921	320	
300	307.531	124.308	310.055	124.343	312.586	124.387	315.123	124.441	317.668	124.505	320.219	124.578	322.777	124.662	325.341	124.755	327.912	124.858	330.489	124.971	333.073	125.094	335.664	125.226	338.261	125.368	300	80 (P)*
250	257.537	103.606	260.066	103.647	262.603	103.701	265.148	103.765	267.701	103.842	270.262	103.930	272.831	104.031	275.408	104.142	277.992	104.266	280.585	104.401	283.185	104.549	285.793	104.708	288.408	104.878	250	
230	237.540	95.327	240.072	95.372	242.612	95.429	245.161	95.500	247.718	95.583	250.284	95.679	252.859	95.788	255.443	95.909	258.034	96.044	260.635	96.191	263.243	96.351	265.860	96.523	268.485	96.709	230	
200	207.546	82.905	210.082	82.950	212.628	83.027	215.184	83.108	217.750	83.203	220.326	83.314	222.912	83.439	225.507	83.579	228.112	83.733	230.727	83.902	233.351	84.086	235.984	84.285	238.626	84.498	200	
170	177.554	70.494	180.097	70.559	182.651	70.633	185.216	70.728	187.794	70.841	190.383	70.971	192.983	71.118	195.594	71.282	198.217	71.464	200.850	71.663	203.494	71.879	206.150	72.112	208.815	72.363	170	65 (P)*
155	162.560	64.289	165.106	64.355	167.665	64.441	170.237	64.545	172.822	64.669	175.419	64.811	178.028	64.972	180.650	65.153	183.283	65.352	185.929	65.570	188.586	65.807	191.255	66.062	193.936	66.337	155	
125	132.574	51.883	135.131	51.965	137.704	52.071	140.292	52.201	142.896	52.354	145.516	52.530	148.150	52.730	150.799	52.953	153.462	53.200	156.140	53.470	158.832	53.764	161.537	54.080	164.257	54.420	125	
100	107.592	41.536	110.163	41.652	112.758	41.789	115.363	41.951	117.992	42.142	120.639	42.363	123.304	42.612	125.987	42.891	128.688	43.199	131.405	43.536	134.140	43.902	136.890	44.296	139.657	44.719	100	
90	97.602	37.426	100.181	37.541	102.781	37.688	105.402	37.868	108.044	38.080	110.706	38.325	113.389	38.602	116.090	38.911	118.810	39.253	121.549	39.627	124.306	40.033	127.080	40.470	129.872	40.939	90	50 (P)*
80	87.615	33.303	90.203	33.432	92.815	33.597	95.450	33.799	98.109	34.038	100.790	34.313	103.492	34.624	106.216	34.972	108.961	35.356	111.725	35.775	114.510	36.231	117.312	36.722	120.134	37.248	80	50 (H)**
70	77.631	29.184	80.231	29.331	82.858	29.520	85.512	29.751	88.191	30.024	90.895	30.338	93.624	30.693	96.375	31.090	99.150	31.527	101.946	32.006	104.763	32.534	107.601	33.083	110.458	33.682	70	
60	67.652	25.074	70.268	25.245	72.915	25.466	75.592	25.735	78.299	26.052	81.033	26.418	83.794	26.832	86.581	27.293	89.393	27.801	92.229	28.357	95.088	28.959	97.968	29.607	100.869	30.301	60	40 (P)*
55	62.666	23.023	65.292	23.210	67.951	23.450	70.643	23.743	73.366	24.089	76.119	24.488	78.900	24.938	81.709	25.440	84.544	25.994	87.403	26.598	90.286	27.252	93.192	27.956	96.118	28.709	55	
50	57.682	20.970	60.319	21.181	62.994	21.446	65.703	21.768	68.445	22.148	71.219	22.586	74.024	23.080	76.858	23.631	79.719	24.237	82.605	24.899	85.516	25.615	88.449	26.385	91.402	27.208	50	40 (H)**
45	52.701	18.934	55.353	19.162	58.038	19.456	60.755	12.813	63.540	20.235	66.340	20.720	69.172	21.268	72.034	21.877	74.925	22.548	77.842	23.280	80.783	24.070	83.746	24.919	86.729	25.825	45	35 (P)**
40	47.725	16.900	50.395	17.156	53.108	17.486	55.863	17.888	58.656	18.361	61.486	18.905	64.350	19.518	67.246	20.200	70.171	20.950	73.122	21.767	76.096	22.648	79.092	23.593	82.107	24.600	40	35 (H) 30 (P)*
35	42.756	14.876	45.448	15.169	48.188	15.545	50.973	16.003	53.801	16.542	56.667	17.160	59.569	17.857	62.503	18.631	65.466	19.479	68.455	20.402	71.466	21.396	74.495	22.459	77.538	23.589	35	
33	40.771	14.070	43.473	14.381	46.226	14.779	49.025	15.264	51.868	15.835	54.751	16.489	57.671	17.225	60.622	18.043	63.602	18.939	66.606	19.911	69.631	20.957	72.672	22.075	75.726	23.262	33	
30	37.796	12.867	40.516	13.209	43.291	13.646	46.115	14.178	48.984	14.803	51.895	15.520	54.841	16.325	57.820	17.217	60.825	18.193	63.852	19.250	66.997	20.386	69.955	21.596	73.020	22.878	30	30 (H)**
25	32.851	10.882	35.610	11.293	38.429	11.815	41.303	12.450	44.224	13.193	47.187	14.042	50.185	14.993	53.210	16.042	56.257	17.185	59.317	18.417	62.384	19.734	65.452	21.129	68.513	22.598	25	
23	30.880	10.101	33.657	10.545	36.498	11.111	39.396	11.798	42.342	12.601	45.328	13.517	48.347	14.541	51.390	15.668	54.449	16.893	57.516	18.209	60.584	19.611	63.643	21.092			23	25 (P)*
20	25.931	8.944	28.743	9.452	31.621	10.100	34.561	10.883	37.546	11.796	40.568	12.833	43.617	13.998	46.690	15.282	49.785	16.679	52.901	18.178							20	25 (H)**
15	23.057	7.089	25.947	7.760	28.910	8.608	31.926	9.625	34.977	10.798	38.044	12.114	41.108	13.559													15	20 (P)*
14	22.092	6.736	25.001	7.452	27.983	8.356	31.015	9.435	34.076	10.677	37.143	12.063															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 90 Degrees

$\Delta = 90°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	2540.103	1035.684	2542.617	1035.703	2545.131	1035.724	2547.647	1035.746	2550.163	1035.769	2552.680	1035.793	2555.198	1035.818	2557.716	1038.845	2560.236	1035.872	2562.756	1035.901	2565.277	1035.931	2567.799	1035.962	2570.322	1035.995	2500	
2200	2240.118	911.440	2242.634	911.462	2245.150	911.486	2247.667	911.511	2250.186	911.537	2252.705	911.564	2255.225	911.593	2257.747	911.623	2260.269	911.655	2262.792	911.687	2265.315	911.722	2267.840	911.757	2270.366	911.794	2200	
2000	2040.130	828.615	2042.647	828.639	2045.166	828.665	2047.685	828.692	2050.205	828.721	2052.726	828.751	2055.248	828.783	2057.771	828.816	2060.296	828.851	2062.821	828.887	2065.347	828.924	2067.875	828.963	2070.403	829.004	2000	
1800	1840.145	745.793	1842.664	745.820	1845.184	745.849	1847.706	745.879	1850.228	745.911	1852.751	745.945	1855.276	745.980	1857.802	746.017	1860.329	746.055	1862.857	746.095	1865.386	746.137	1867.917	746.180	1870.448	746.225	1800	
1560	1540.175	621.571	1542.698	621.604	1545.222	621.638	1547.747	621.674	1550.274	621.713	1552.802	621.753	1555.332	621.795	1557.863	621.839	1560.395	621.885	1562.928	621.934	1565.463	621.984	1568.000	622.035	1570.537	622.090	1560	
1200	1240.219	497.379	1242.748	497.411	1245.278	497.454	1247.809	497.499	1250.343	497.547	1252.878	497.597	1255.415	497.650	1257.953	497.705	1260.494	497.763	1263.035	497.823	1265.579	497.885	1268.124	497.951	1270.671	498.018	1200	
1000	1040.263	414.590	1042.797	414.639	1045.333	414.690	1047.871	414.745	1050.411	414.802	1052.953	414.863	1055.497	414.926	1058.043	414.992	1060.592	415.062	1063.142	415.134	1065.694	415.209	1068.248	415.287	1070.804	415.368	1000	
900	940.292	373.211	942.830	373.265	945.370	373.322	947.912	373.383	950.457	373.447	953.003	373.513	955.552	373.584	958.103	373.657	960.656	373.734	963.212	373.814	965.770	373.898	968.330	373.985	970.892	374.075	900	
800	840.329	331.842	842.871	331.903	845.416	331.967	847.963	332.035	850.513	332.107	853.066	332.183	855.621	332.262	858.178	332.344	860.738	332.431	863.300	332.521	865.865	332.615	868.432	332.713	871.002	332.814	800	
700	740.375	290.488	742.924	290.557	745.475	290.631	748.029	290.709	750.586	290.791	753.145	290.877	755.708	290.968	758.273	291.062	760.841	291.161	763.412	291.264	765.986	291.371	768.562	291.483	771.142	291.599	700	
600	640.438	249.156	642.994	249.238	645.553	249.323	648.116	249.414	650.682	249.510	653.251	249.610	655.824	249.716	658.400	249.826	660.979	249.941	663.561	250.062	666.147	250.187	668.736	250.317	671.328	250.452	600	
500	540.524	207.861	543.091	207.958	545.662	208.061	548.237	208.170	550.816	208.285	553.398	208.406	555.985	208.532	558.575	208.665	561.170	208.803	563.768	208.947	566.370	209.097	568.976	209.253	571.586	209.415	500	
400	440.653	166.628	443.236	166.749	445.824	166.878	448.417	167.014	451.014	167.157	453.617	167.308	456.224	167.467	458.837	167.632	461.453	167.805	464.075	167.985	466.701	168.173	469.332	168.367	471.968	168.570	400	
360	400.724	150.164	403.315	150.299	405.913	150.442	408.516	150.593	411.124	150.752	413.738	150.920	416.356	151.096	418.980	151.280	421.609	151.471	424.243	151.671	426.883	151.880	429.527	152.096	432.177	152.321	360	100 (P)*
350	390.744	146.052	393.338	146.190	395.938	146.337	398.544	146.493	401.155	146.657	403.772	146.829	406.394	147.010	409.021	147.199	411.653	147.396	414.291	147.602	416.934	147.816	419.583	148.039	422.236	148.270	350	
300	340.864	125.520	343.474	125.682	346.090	125.854	348.712	126.035	351.341	126.226	353.976	126.427	356.616	126.638	359.264	126.858	361.917	127.088	364.576	127.328	367.241	127.578	369.912	127.837	372.590	128.106	300	
250	291.031	105.060	293.662	105.254	296.300	105.460	298.945	105.678	301.597	105.907	304.257	106.148	306.924	106.400	309.598	106.665	312.280	106.940	314.968	107.228	317.663	107.527	320.365	107.838	323.075	108.160	250	
230	271.118	96.907	273.739	97.118	276.408	97.341	279.065	97.578	281.729	97.827	284.402	98.088	287.083	98.363	289.771	98.650	292.466	98.949	295.169	99.261	297.880	99.586	300.598	99.924	303.323	100.274	230	80 (P)*
200	241.278	84.726	243.939	84.968	246.608	85.225	249.287	85.496	251.974	85.782	254.671	86.083	257.375	86.398	260.089	86.728	262.811	87.072	265.541	87.430	268.279	87.803	271.026	88.190	273.781	88.592	200	
170	211.492	72.630	214.178	72.915	216.875	73.217	219.582	73.536	222.299	73.872	225.026	74.225	227.763	74.595	230.509	74.982	233.265	75.385	236.030	75.806	238.805	76.244	241.588	76.698	244.381	77.169	170	
155	196.628	66.630	199.331	66.942	202.045	67.273	204.769	67.623	207.505	67.991	210.251	68.377	213.008	68.782	215.775	69.206	218.552	69.648	221.339	70.109	224.135	70.588	226.941	71.085	229.757	71.600	155	65 (P)*
125	166.988	54.783	169.235	55.169	172.494	55.577	175.265	56.009	178.049	56.464	180.845	56.941	183.652	57.441	186.472	57.964	189.303	58.509	192.145	59.077	194.998	59.667	197.861	60.279	200.735	60.913	125	
100	142.439	45.171	145.236	45.651	148.049	46.160	150.875	46.697	153.716	47.262	156.570	47.854	159.437	48.475	162.318	49.123	165.210	49.798	168.115	50.501	171.031	51.231	173.959	51.987	176.897	52.771	100	
90	132.680	41.440	135.504	41.972	138.344	42.535	141.199	43.130	144.069	43.755	146.953	44.410	149.850	45.097	152.761	45.813	155.684	46.559	158.619	47.335	161.566	48.140	164.524	48.975	167.492	49.838	90	50 (P)
80	122.973	37.809	125.829	38.405	128.701	39.036	131.589	39.702	134.492	40.401	137.410	41.134	140.341	41.901	143.286	42.700	146.243	43.533	149.213	44.398	152.193	45.296	155.184	46.225	158.185	47.185	80	50 (H)**
70	113.334	34.320	116.227	34.997	119.138	35.714	122.065	36.468	125.007	37.261	127.963	38.091	130.933	38.959	133.916	39.863	136.910	40.804	139.916	41.780	142.931	42.791	145.956	43.837	148.989	44.917	70	
60	103.789	31.039	106.727	31.823	109.683	32.650	112.654	33.520	115.639	34.434	118.638	35.389	121.650	36.386	124.672	37.423	127.703	38.500	130.746	39.617	133.795	40.772	136.850	41.964	139.910	43.193	60	40 (P)*
55	99.063	29.510	102.026	30.339	105.006	31.255	108.001	32.197	111.010	33.185	114.031	34.217	117.063	35.292	120.104	36.410	123.154	37.570	126.210	38.771	129.271	40.011	132.337	41.290	135.404	42.607	55	
50	94.375	28.083	97.365	29.009	100.370	29.985	103.389	31.010	106.421	32.084	109.463	33.204	112.513	34.370	115.571	35.581	118.634	36.835	121.700	38.131	124.768	39.468	127.837	40.844	130.904	42.258	50	40 (H)**
45	89.731	26.788	92.748	27.805	95.779	28.875	98.821	29.998	101.873	31.172	104.932	32.394	107.997	33.665	111.064	34.982	114.133	36.343	117.209	37.747	120.265	39.191	123.324	40.676	126.376	42.197	45	35 (P)*
40	85.137	25.667	88.180	26.793	91.233	27.976	94.294	29.214	97.360	30.505	100.428	31.846	103.497	33.237	106.562	34.674	109.621	36.156	112.673	37.680							40	30 (H)**
35	80.594	24.284	83.657	26.040	86.724	27.357	89.793	28.730	92.859	30.158	95.919	31.637															35	
33	78.789	24.516	81.856	25.832	84.925	27.209	87.990	28.643	91.049	30.130																	33	30 (P)*
30	76.089	24.228	79.155	25.643	82.216	27.117																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

△=91°

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 91 Degrees

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
m&yd	T_S	E_T	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	2551.518	1066.797	2554.021	1066.802	2556.523	1066.807	2559.030	1066.813	2561.535	1066.821	2564.042	1066.830	2566.549	1066.840	2569.057	1066.852	2571.566	1066.864	2574.075	1066.878	2576.586	1066.892	2579.097	1066.909	2581.610	1066.926	2500	
2200	2246.237	938.783	2248.740	938.788	2251.245	938.794	2253.750	938.801	2256.256	938.810	2258.763	938.820	2261.272	938.832	2263.781	938.844	2266.291	938.859	2268.802	938.874	2271.314	938.891	2273.827	938.909	2276.341	938.929	2200	
2000	2042.716	853.440	2045.220	853.446	2047.725	853.452	2050.231	853.460	2052.738	853.470	2055.246	853.481	2057.755	853.494	2060.264	853.508	2062.775	853.523	2065.288	853.541	2067.801	853.559	2070.315	853.579	2072.830	853.601	2000	
1800	1839.196	768.098	1841.700	768.104	1844.205	768.111	1846.711	768.120	1849.219	768.131	1851.728	768.143	1854.238	768.157	1856.749	768 173	1859.261	768.190	1861.775	768.209	1864.290	768.230	1866.805	768.252	1869.322	768.276	1800	
1500	1533.915	640.084	1536.420	640.091	1538.926	640.100	1541.434	640.111	1543.943	640.124	1546.454	640.139	1548.966	640.155	1551.479	640.174	1553.994	640.195	1556.510	640.218	1559.028	640.243	1561.547	640.270	1564.067	640.298	1500	
1200	1228.635	512.071	1231.141	512.080	1233.649	512.091	1236.159	512.105	1238.670	512.121	1241.183	512.140	1243.698	512.160	1246.215	512.184	1248.733	512.210	1251.253	512.239	1253.776	512.270	1256.299	512.303	1258.824	512.339	1200	
1000	1025.115	426.730	1027.623	426.740	1030.132	426.754	1032.644	426.771	1035.157	426.790	1037.673	426.812	1040.191	426.837	1042.711	426.865	1045.233	426.896	1047.757	426.931	1050.284	426.968	1052.812	427.008	1055.343	427.051	1000	
900	923.356	384.060	925.864	384.072	928.375	384.087	930.887	384.105	933.403	384.126	935.920	384.151	938.440	384.179	940.962	384.210	943.487	384.245	946.014	384.283	948.543	384.324	951.074	384.369	953.608	384.417	900	
800	821.596	341.390	824.106	341.403	826.618	341.420	829.132	341.440	831.649	341.464	834.169	341.492	836.691	341.524	839.216	341.559	841.744	341.598	844.274	341.641	846.807	341.687	849.342	341.738	851.880	341.792	800	
700	719.838	299.121	722.348	298.736	724.862	298.755	727.378	298.778	729.898	298.806	732.420	298.838	734.946	298.874	737.474	298.914	740.006	298.958	742.541	299.008	745.077	299.061	747.618	299.118	750.161	299.179	700	100 (P)*
600	618.079	256.052	620.592	256.070	623.107	256.092	625.627	256.119	628.149	256.151	630.676	256.188	633.206	256.231	635.739	256.278	638.275	256.330	640.815	256.387	643.359	256.449	645.906	256.516	648.456	256.587	600	
500	516.322	213.385	518.837	213.406	521.355	213.433	523.879	213.465	526.406	213.504	528.938	213.549	531.473	213.599	534.013	213.656	536.557	213.718	539.104	213.786	541.656	213.861	544.213	213.941	546.773	214.027	500	
400	414.566	170.720	417.084	170.746	419.608	170.780	422.137	170.821	424.671	170.869	427.210	170.925	429.755	170.988	432.304	171.058	434.858	171.136	437.418	171.222	439.983	171.314	442.552	171.415	445.127	171.522	400	
360	373.865	153.655	376.385	153.684	378.911	153.721	381.443	153.767	383.981	153.820	386.524	153.882	389.074	153.952	391.629	154.031	394.189	154.117	396.755	154.212	399.327	154.315	401.904	154.427	404.487	154.547	360	
350	363.689	149.389	366.210	149.419	368.737	149.457	371.270	149.504	373.809	149.559	376.354	149.623	378.904	149.695	381.461	149.775	384.023	149.865	386.591	149.962	389.163	150.068	391.744	150.183	394.329	150.306	350	
300	312.813	128.060	315.338	128.094	317.869	128.139	320.408	128.193	322.953	128.258	325.505	128.332	328.064	128.416	330.629	128.510	333.201	128.614	335.780	128.728	338.366	128.852	340.958	128.985	343.557	129.129	300	80 (P)*
250	261.939	106.733	264.469	106.774	267.006	106.828	269.552	106.893	272.106	106.970	274.668	107.060	277.239	107.161	279.817	107.273	282.403	107.398	284.997	107.535	287.599	107.683	290.209	107.844	292.827	108.016	250	
230	241.391	98.203	244.122	98.248	246.663	98.306	249.213	98.377	251.772	98.461	254.339	98.558	256.915	98.668	259.500	98.791	262.094	98.926	264.696	99.075	267.306	99.236	269.925	99.410	272.552	99.597	230	
200	211.069	85.410	213.605	85.462	216.152	85.529	218.709	85.611	221.276	85.707	223.854	85.819	226.441	85.945	229.038	86.086	231.645	86.242	234.261	86.413	236.887	86.598	239.523	86.798	242.168	87.013	200	
170	180.549	72.621	183.092	72.682	185.647	72.760	188.214	72.856	190.792	72.970	193.383	73.101	195.985	73.250	198.598	73.415	201.223	73.599	203.859	73.799	206.506	74.017	209.164	74.255	211.833	74.505	170	65 (P)*
155	165.290	66.227	167.837	66.294	170.397	66.381	172.970	66.486	175.556	66.611	178.155	66.754	180.767	66.917	183.390	67.099	186.027	67.300	188.675	67.520	191.335	67.759	194.007	68.017	196.691	68.294	155	
125	134.776	53.447	137.334	53.530	139.908	53.637	142.499	53.767	145.105	53.922	147.726	54.100	150.363	54.302	153.014	54.527	155.681	54.776	158.362	55.048	161.057	55.344	163.767	55.663	166.490	56.006	125	
100	109.355	43.805	111.922	42.909	114.519	43.043	117.131	43.206	119.762	43.399	122.411	43.621	125.080	43.873	127.766	44.155	130.471	44.465	133.192	44.805	135.931	45.174	138.687	45.572	141.459	45.999	100	
90	99.189	38.553	101.769	38.669	104.371	38.817	106.994	38.998	109.639	39.213	112.304	39.459	114.990	39.739	117.695	40.051	120.420	40.396	123.163	40.773	125.925	41.182	128.705	41.624	131.502	42.097	90	50 (P)*
80	89.025	34.304	91.615	34.434	94.229	34.601	96.867	34.805	99.529	35.046	102.213	35.324	104.919	35.638	107.648	35.989	110.397	36.376	113.167	36.799	115.957	37.258	118.766	37.754	121.593	38.285	80	50 (H)**
70	78.866	30.061	81.468	30.210	84.097	30.400	86.754	30.633	89.436	30.908	92.144	31.225	94.877	31.584	97.634	31.984	100.414	32.425	103.216	32.907	106.040	33.431	108.884	33.999	111.749	34.598	70	
60	68.711	25.826	71.329	25.999	73.979	26.221	76.660	26.493	79.370	26.813	82.109	27.182	84.875	27.599	87.668	28.065	90.487	28.578	93.329	29.138	96.196	29.745	99.084	30.399	101.993	31.099	60	40 (P)*
55	63.637	23.712	66.265	23.901	68.928	24.144	71.623	24.440	74.350	24.789	77.108	25.191	79.895	25.645	82.710	26.152	85.552	26.710	88.419	27.319	91.310	27.979	94.224	28.690	97.160	29.449	55	
50	58.565	21.603	61.206	21.811	63.883	22.077	66.596	22.402	69.343	22.786	72.123	23.227	74.934	23.726	77.775	24.282	80.643	24.894	83.538	25.561	86.457	26.284	89.400	27.061	92.363	27.891	50	40 (H)**
45	53.497	19.499	56.152	19.730	58.847	20.026	61.582	20.386	64.352	20.812	67.158	21.301	69.997	21.854	72.867	22.469	75.766	23.146	78.692	23.883	81.643	24.681	84.617	25.537	87.611	26.451	45	35 (P)*
40	48.434	17.403	51.106	17.662	53.824	17.994	56.583	18.400	59.383	18.877	62.220	19.425	65.091	20.044	67.996	20.733	70.930	21.489	73.891	22.313	76.876	23.202	79.884	24.155	82.911	25.171	40	35 (H) 30 (P)*
35	43.377	15.317	46.072	15.613	48.817	15.992	51.608	16.454	54.442	16.997	57.316	17.621	60.227	18.324	63.171	19.105	66.145	19.961	69.145	20.892	72.168	21.894	75.210	22.967	78.268	24.107	35	
33	41.357	14.486	44.063	14.800	46.820	15.202	49.626	15.691	52.476	16.266	55.368	16.926	58.296	17.670	61.257	18.494	64.248	19.398	67.265	20.379	70.302	21.434	73.358	22.562	76.426	23.760	33	
30	38.330	13.246	41.034	13.591	43.824	14.032	46.665	14.569	49.542	15.200	52.461	15.922	55.418	16.734	58.408	17.634	61.425	18.619	64.466	19.686	67.525	20.831	70.597	22.053	73.678	23.346	30	30 (H)**
25	33.298	11.201	36.062	11.614	38.887	12.141	41.769	12.781	44.700	13.530	47.673	14.387	50.681	15.346	53.721	16.405	56.782	17.558	59.857	18.801	62.941	20.129	66.026	21.537	69.106	23.018	25	
23	31.292	10.564	34.075	10.841	36.923	11.413	39.829	12.106	42.785	12.916	45.782	13.840	48.814	14.873	51.871	16.010	54.946	17.246	58.029	18.574	61.114	19.988	64.192	21.482			23	25 (P)*
20	28.292	9.200	31.110	9.713	33.998	10.366	36.945	11.136	39.942	12.077	42.977	13.124	46.040	14.288	49.119	15.564	52.204	16.942	55.285	18.415							20	25 (H)**
15	23.332	7.285	26.231	7.961	29.204	8.817	32.233	9.843	35.299	11.026	38.382	12.354	41.464	13.813													15	20 (P)*
14	22.350	6.970	25.268	7.642	28.261	8.554	31.307	9.643	34.383	10.895	37.468	12.294															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 91 Degrees

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=91°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2584.123	1066.944	2586.636	1066.964	2589.151	1066.985	2591.667	1067.007	2594.183	1067.030	2596.701	1067.054	2599.219	1067.080	2601.738	1067.106	2604.258	1067.135	2606.778	1067.164	2609.300	1067.194	2611.822	1067.225	2614.345	1067.258	2500	
2200	2278.855	938.950	2281.371	938.972	2283.888	938.996	2286.406	939.021	2288.925	939.047	2291.444	939.075	2293.965	939.104	2296.486	939.134	2299.009	939.166	2301.532	939.199	2304.056	939.234	2306.582	939.270	2309.108	939.306	2200	
2000	2075.347	853.624	2077.864	853.648	2080.383	853.674	2082.902	853.702	2085.423	853.731	2087.944	853.761	2090.467	853.793	2092.990	853.826	2095.515	853.862	2098.041	853.898	2100.568	853.936	2103.095	853.975	2105.624	854.016	2000	
1800	1871.841	768.302	1874.360	768.329	1876.880	768.358	1879.402	768.388	1881.925	768.420	1884.448	768.454	1886.974	768.490	1889.500	768.527	1892.027	768.566	1894.556	768.606	1897.085	768.648	1899.616	768.692	1902.149	768.737	1800	
1500	1566.589	640.329	1569.112	640.362	1571.636	640.396	1574.162	640.433	1576.689	640.472	1579.218	640.512	1581.748	640.555	1584.280	640.599	1586.812	640.646	1589.347	640.695	1591.882	640.745	1594.419	640.797	1596.958	640.852	1500	
1200	1261.352	512.377	1263.881	512.418	1266.411	512.461	1268.943	512.507	1271.477	512.555	1274.013	512.606	1276.551	512.660	1279.090	512.715	1281.631	512.773	1284.173	512.834	1286.718	512.897	1289.264	512.963	1291.812	513.031	1200	
1000	1057.875	427.097	1060.410	427.146	1062.946	427.198	1065.485	427.253	1068.026	427.311	1070.568	427.372	1073.113	427.436	1075.660	427.503	1078.209	427.573	1080.760	427.646	1083.313	427.721	1085.868	427.800	1088.425	427.882	1000	
900	956.144	384.468	958.682	384.522	961.223	384.580	963.766	384.641	966.311	384.706	968.859	384.773	971.408	384.844	973.960	384.918	976.515	384.996	979.071	385.077	981.630	385.161	984.191	385.249	986.754	385.340	900	
800	854.420	341.849	856.964	341.910	859.509	341.975	862.057	342.044	864.608	342.116	867.161	342.193	869.717	342.272	872.275	342.356	874.836	342.443	877.400	342.534	879.966	342.629	882.534	342.727	885.105	342.829	800	
700	752.707	299.245	755.256	299.315	757.809	299.390	760.363	299.468	762.921	299.551	765.482	299.638	768.045	299.729	770.612	299.825	773.181	299.924	775.753	300.028	778.329	300.136	780.907	300.249	783.487	300.366	700	
600	651.010	256.664	653.567	256.746	656.127	256.833	658.691	256.924	661.259	257.021	663.829	257.122	666.403	257.229	668.980	257.340	671.561	257.457	674.145	257.578	676.732	257.704	679.322	257.835	681.916	257.971	600	
500	549.337	214.119	551.905	214.217	554.477	214.321	557.054	214.431	559.634	214.547	562.218	214.669	564.806	214.796	567.398	214.930	569.995	215.070	572.594	215.215	575.198	215.366	577.806	215.524	580.418	215.687	500	
400	447.707	171.638	450.292	171.760	452.881	171.890	455.476	172.027	458.075	172.172	460.680	172.324	463.289	172.484	465.904	172.651	468.522	172.825	471.146	173.007	473.775	173.196	476.408	173.393	479.046	173.597	400	
360	407.075	154.675	409.669	154.810	412.268	154.955	414.873	155.107	417.483	155.268	420.099	155.437	422.719	155.615	425.345	155.800	427.977	155.994	430.614	156.195	433.256	156.406	435.903	156.624	438.555	156.850	360	100 (P)*
350	396.920	150.437	399.516	150.577	402.118	150.726	404.726	150.883	407.339	151.048	409.957	151.222	412.581	151.404	415.211	151.595	417.846	151.794	420.486	152.002	423.132	152.218	425.783	152.442	428.440	152.675	350	
300	346.162	129.282	348.774	129.446	351.392	129.619	354.017	129.802	356.647	129.995	359.285	130.197	361.928	130.410	364.578	130.632	367.234	130.864	369.896	131.106	372.565	131.358	375.239	131.620	377.920	131.892	300	
250	295.452	108.200	298.085	108.396	300.725	108.603	303.373	108.823	306.028	109.054	308.691	109.297	311.361	109.552	314.039	109.818	316.724	110.096	319.416	110.386	322.115	110.688	324.821	111.001	327.534	111.327	250	
230	275.188	99.797	277.831	100.010	280.483	100.236	283.143	100.474	285.811	100.725	288.487	100.989	291.171	101.266	293.862	101.555	296.562	101.858	299.269	102.173	301.983	102.500	304.706	102.841	307.435	103.194	230	80 (P)*
200	244.823	87.243	247.486	87.487	250.159	87.747	252.841	88.021	255.532	88.309	258.232	88.612	260.941	88.930	263.658	89.263	266.385	89.610	269.119	89.971	271.862	90.348	274.614	90.739	277.373	91.144	200	
170	214.512	74.775	217.203	75.063	219.903	75.367	222.614	75.689	225.336	76.028	228.067	76.384	230.808	76.757	233.559	77.148	236.320	77.555	239.091	77.979	241.871	78.421	244.660	78.879	247.458	79.354	170	
155	199.387	68.590	202.094	68.905	204.812	69.238	207.541	69.591	210.281	69.962	213.032	70.352	215.794	70.761	218.566	71.188	221.349	71.634	224.141	72.099	226.944	72.582	229.756	73.084	232.578	73.604	155	65 (P)*
125	169.228	55.372	171.978	56.761	174.742	57.174	177.519	57.610	180.308	58.068	183.110	58.550	185.924	59.054	188.750	59.582	191.587	60.132	194.436	60.704	197.297	61.300	200.168	61.917	203.050	62.557	125	
100	144.246	46.455	147.050	46.939	149.868	47.452	152.701	47.994	155.549	48.564	158.411	49.162	161.286	49.788	164.174	50.441	167.075	51.123	169.989	51.832	172.914	52.568	175.851	53.331	178.799	54.121	100	
90	134.317	42.602	137.147	43.139	139.994	43.707	142.857	44.307	145.734	44.937	148.626	45.599	151.532	46.291	154.451	47.014	157.384	47.766	160.329	48.549	163.286	49.362	166.254	50.203	169.233	51.075	90	50 (P)
80	124.459	38.851	127.303	39.452	130.183	40.089	133.079	40.760	135.991	41.465	138.918	42.205	141.859	42.978	144.814	43.785	147.781	44.625	150.761	45.498	153.753	46.403	156.755	47.341	159.768	48.310	80	50 (H)**
70	114.633	35.242	117.535	35.926	120.454	36.648	123.390	37.410	126.342	38.209	129.309	39.047	132.289	39.922	135.283	40.835	138.290	41.783	141.307	42.768	144.335	43.788	147.373	44.844	150.420	45.933	70	
60	104.923	31.844	107.871	32.634	110.836	33.469	113.818	34.347	116.815	35.269	119.826	36.232	122.850	37.238	125.885	38.285	128.931	39.371	131.986	40.498	135.049	41.662	138.119	42.865	141.194	44.105	60	40 (P)*
55	100.115	30.258	103.089	31.114	106.080	32.018	109.087	32.968	112.108	33.964	115.142	35.005	118.187	36.090	121.242	37.218	124.306	38.389	127.377	39.600	130.454	40.851	133.535	42.141	136.619	43.470	55	
50	95.347	28.773	98.348	29.708	101.366	30.692	104.398	31.727	107.443	32.809	110.499	33.940	113.564	35.116	116.636	36.337	119.715	37.602	122.797	38.910	125.882	40.259	128.968	41.647	132.052	43.074	50	40 (H)**
45	90.624	27.422	93.654	28.448	96.698	29.528	99.755	30.661	102.821	31.845	105.896	33.079	108.976	34.360	112.060	35.689	115.145	37.062	118.230	38.478	121.313	39.936	124.391	41.433	127.462	42.968	45	35 (P)*
40	85.954	26.348	89.011	27.383	92.079	28.577	95.156	29.826	98.238	31.128	101.323	32.482	104.408	33.885	107.491	35.335	110.569	36.829	113.640	38.367							40	30 (H)**
35	81.338	25.312	84.417	26.580	87.501	27.908	90.586	29.294	93.670	30.734	96.748	32.226															35	
33	79.505	25.024	82.589	26.352	85.674	27.741	88.757	29.188	91.834	30.689																	33	30 (P)*
30	76.764	24.708	79.848	26.135	82.927	27.622																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 92 Degrees

$\Delta = 92°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2994.327	1098.893	2998.830	1098.897	2601.334	1098.903	2603.838	1098.909	2606.344	1098.917	2608.850	1098.926	2611.358	1098.937	2613.866	1098.948	2616.375	1098.961	2618.885	1098.974	2621.396	1098.989	2623.907	1099.006	2626.420	1099.023	2500	
2300	2285.668	967.027	2288.172	967.032	2290.676	967.038	2293.182	967.046	2295.688	967.055	2298.196	967.065	2300.704	967.077	2303.213	967.090	2305.723	967.104	2308.234	967.119	2310.747	967.137	2313.260	967.155	2315.774	967.175	2300	
2000	2078.563	879.117	2081.067	879.122	2083.572	879.129	2086.078	879.137	2088.585	879.147	2091.093	879.158	2093.602	879.171	2096.112	879.185	2098.623	879.201	2101.136	879.218	2103.649	879.237	2106.164	879.257	2108.679	879.279	2000	
1800	1871.458	791.207	1873.962	791.213	1876.467	791.220	1878.974	791.229	1881.482	791.240	1883.991	791.253	1886.501	791.267	1889.012	791.283	1891.525	791.300	1894.038	791.319	1896.553	791.340	1899.070	791.363	1901.587	791.387	1800	
1500	1560.800	659.342	1563.305	659.349	1565.812	659.358	1568.320	659.369	1570.829	659.382	1573.340	659.397	1575.852	659.414	1578.365	659.433	1580.880	659.454	1583.397	659.477	1585.915	659.502	1588.434	659.529	1590.955	659.558	1500	
1200	1250.143	527.478	1252.649	527.486	1255.157	527.498	1257.667	527.511	1260.179	527.527	1262.692	527.546	1265.208	527.567	1267.725	527.591	1270.243	527.617	1272.764	527.646	1275.286	527.677	1277.810	527.711	1280.336	527.747	1200	
1000	1043.039	439.569	1045.546	439.579	1048.056	439.593	1050.568	439.609	1053.082	439.629	1055.598	439.651	1058.116	439.677	1060.637	439.705	1063.159	439.737	1065.683	439.771	1068.210	439.809	1070.739	439.849	1073.270	439.893	1000	
900	939.487	395.613	941.995	395.626	944.506	395.641	947.019	395.660	949.535	395.681	952.052	395.706	954.573	395.735	957.095	395.766	959.621	395.801	962.148	395.840	964.677	395.881	967.209	395.926	969.744	395.975	900	
800	835.936	351.661	838.445	351.674	840.957	351.691	843.472	351.712	845.989	351.736	848.509	351.764	851.032	351.795	853.557	351.832	856.085	351.871	858.616	351.914	861.149	351.961	863.685	352.011	866.224	352.066	800	
700	732.384	307.708	734.895	307.723	737.409	307.742	739.926	307.766	742.446	307.794	744.969	307.826	747.495	307.862	750.023	307.903	752.555	307.948	755.091	307.997	757.628	308.051	760.170	308.109	762.713	308.170	700	100 (P)*
600	628.834	263.756	631.346	263.773	633.862	263.796	636.382	263.823	638.903	263.855	641.432	263.893	643.962	263.936	646.496	263.983	649.033	264.035	651.574	264.093	654.118	264.156	656.666	264.223	659.217	264.295	600	
500	525.284	219.805	527.799	219.826	530.318	219.853	532.842	219.885	535.370	219.925	537.902	219.969	540.438	220.021	542.978	220.077	545.523	220.140	548.072	220.209	550.625	220.284	553.182	220.365	555.743	220.452	500	
450	421.736	175.856	424.255	175.882	426.779	175.916	429.308	175.957	431.843	176.006	434.383	176.062	436.928	176.126	439.478	176.197	442.033	176.275	444.594	176.362	447.160	176.455	449.731	176.557	452.307	176.665	450	
400	380.318	158.278	382.838	158.307	385.365	158.344	387.897	158.390	390.436	158.444	392.980	158.506	395.530	158.577	398.086	158.656	400.648	158.744	403.215	158.839	405.788	158.943	408.366	159.056	410.951	159.177	400	
350	369.863	153.883	372.484	153.913	375.012	153.951	377.545	153.999	380.085	154.054	382.630	154.118	385.182	154.191	387.739	154.273	390.302	154.363	392.872	154.461	395.447	154.568	398.027	154.684	400.614	154.808	350	
300	318.191	131.912	320.716	131.947	323.248	131.992	325.787	132.046	328.333	132.112	330.886	132.186	333.446	132.271	336.012	132.366	338.586	132.471	341.166	132.586	343.754	132.711	346.347	132.846	348.948	132.990	300	80 (P)*
280	296.421	109.943	268.951	109.985	271.489	110.039	274.036	110.105	276.591	110.183	279.154	110.272	281.726	110.375	284.305	110.488	286.893	110.614	289.489	110.752	292.093	110.902	294.704	111.064	297.324	111.237	280	
250	265.714	101.156	268.246	101.202	270.788	101.261	253.338	101.332	255.898	101.417	258.467	101.515	261.044	101.626	263.631	101.750	266.226	101.886	268.830	102.036	271.442	102.199	274.063	102.375	276.693	102.563	250	
230	214.654	87.979	217.191	88.031	219.739	88.098	222.297	88.181	224.866	88.278	227.444	88.391	230.033	88.518	232.632	88.660	235.241	88.818	237.859	88.990	240.488	89.177	243.126	89.379	245.774	89.596	230	
200	183.597	74.804	186.140	74.865	188.696	74.945	191.264	75.042	193.845	75.156	196.437	75.289	199.040	75.438	201.656	75.606	204.283	75.791	206.922	75.993	209.571	76.213	212.232	76.451	214.904	76.706	200	65 (P)*
180	168.069	68.218	170.617	68.286	173.178	68.373	175.753	68.479	178.340	68.605	180.941	68.750	183.554	68.914	186.181	69.098	188.819	69.300	191.470	69.522	194.134	69.763	196.809	70.024	199.497	70.303	180	
160	147.018	55.052	139.577	55.136	142.153	55.244	144.744	55.376	147.352	55.532	149.976	55.711	152.615	55.915	155.270	56.142	157.939	56.393	160.624	56.668	163.323	56.967	166.037	57.289	168.764	57.635	160	
140	111.140	44.096	113.722	44.195	116.316	44.330	118.930	44.495	121.565	44.689	124.219	44.914	126.887	45.168	129.577	45.452	132.285	45.765	135.011	46.108	137.755	46.480	140.515	46.882	143.293	47.313	140	
120	100.804	39.710	103.383	39.826	105.989	39.976	108.615	40.159	111.262	40.375	113.930	40.624	116.619	40.907	119.329	41.222	122.058	41.569	124.806	41.950	127.573	42.363	130.358	42.808	133.162	43.286	120	50 (P)*
100	90.461	35.333	93.053	35.464	95.669	35.633	98.310	35.838	100.974	36.081	103.662	36.361	106.372	36.678	109.105	37.032	111.859	37.423	114.634	37.850	117.430	38.314	120.245	38.813	123.079	39.349	100	50 (H)**
90	80.123	30.962	82.727	31.111	85.359	31.304	88.018	31.539	90.704	31.816	93.416	32.136	96.153	32.498	98.915	32.901	101.701	33.347	104.509	33.833	107.339	34.361	110.191	34.930	113.063	35.540	90	
80	69.790	26.598	72.410	26.773	75.062	26.997	77.746	27.271	80.460	27.594	83.204	27.966	85.976	28.388	88.774	28.857	91.599	29.375	94.449	29.940	97.323	30.553	100.220	31.213	103.138	31.919	80	
70	64.626	24.421	67.257	24.611	69.922	24.856	72.621	25.154	75.353	25.507	78.116	25.912	80.908	26.371	83.730	26.882	86.579	27.445	89.453	28.060	92.353	28.726	95.276	29.443	98.221	30.209	70	40 (P)*
60	59.465	22.247	62.108	22.457	64.789	22.726	67.506	23.054	70.258	23.441	73.043	23.886	75.860	24.390	78.708	24.950	81.584	25.568	84.487	26.241	87.415	26.970	90.368	27.754	93.342	28.592	60	40 (H)**
55	54.307	20.080	56.965	20.312	59.664	20.611	62.403	20.975	65.179	21.404	67.991	21.898	70.837	22.455	73.715	23.076	76.622	23.759	79.557	24.503	82.518	25.308	85.503	26.172	88.509	27.094	55	35 (P)*
50	49.155	17.919	51.831	18.181	54.552	18.516	57.317	18.925	60.122	19.407	62.966	19.960	65.846	20.585	68.759	21.278	71.702	22.042	74.674	22.873	77.670	23.770	80.690	24.732	83.730	25.757	50	35 (H) 30 (P)*
45	44.009	15.769	46.768	16.068	49.458	16.451	52.254	16.917	55.095	17.465	57.977	18.095	60.897	18.804	63.851	19.592	66.835	20.456	69.847	21.395	72.882	22.406	75.938	23.488	79.010	24.639	45	
40	41.953	14.914	44.663	15.230	47.426	15.636	50.238	16.129	53.095	16.710	55.995	17.376	58.932	18.125	61.904	18.957	64.907	19.869	67.935	20.859	70.986	21.924	74.056	23.062	77.140	24.271	40	30 (H)**
35	38.873	13.635	41.602	13.983	44.387	14.429	47.225	14.970	50.110	15.606	53.038	16.335	56.005	17.155	59.006	18.063	62.036	19.056	65.090	20.133	68.163	21.289	71.251	22.521	74.349	23.826	35	
30	33.753	11.527	36.522	11.943	39.354	12.475	42.243	13.121	45.184	13.877	48.168	14.741	51.190	15.709	54.242	16.777	57.316	17.941	60.408	19.195	63.508	20.535	66.611	21.956	69.709	23.450	30	
25	31.711	10.694	34.500	11.146	37.355	11.723	40.270	12.422	43.236	13.239	46.245	14.171	49.290	15.214	52.361	16.361	55.451	17.608	58.552	18.948	61.654	20.375	64.751	21.882			25	25 (P)*
20	28.659	9.463	31.483	9.980	34.379	10.640	37.337	11.437	40.345	12.366	43.393	13.422	46.470	14.597	49.566	15.884	52.668	17.275	55.767	18.760							20	25 (H)**
15	23.612	7.485	26.319	8.168	29.503	9.031	32.545	10.066	35.625	11.260	38.725	12.600	41.825	14.070													15	20 (P)*
14	22.613	7.108	25.540	7.837	28.545	8.757	31.604	9.855	34.696	11.119	37.798	12.530															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 92 Degrees

$\Delta = 92°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	2628.933	1099.042	2631.447	1099.061	2633.962	1099.082	2636.478	1099.104	2638.995	1099.128	2641.512	1099.153	2644.031	1099.178	2646.550	1099.203	2649.070	1099.233	2651.591	1099.263	2654.113	1099.293	2656.636	1099.325	2659.159	1099.358	2500	
2200	2318.289	967.196	2320.805	967.218	2323.322	967.242	2325.840	967.267	2328.360	967.294	2330.879	967.322	2333.400	967.351	2335.922	967.382	2338.445	967.414	2340.969	967.447	2343.494	967.482	2346.019	967.518	2348.546	967.556	2200	
2000	2111.196	879.302	2113.714	879.327	2116.232	879.353	2118.752	879.381	2121.273	879.410	2123.795	879.441	2126.318	879.473	2128.842	879.507	2131.367	879.542	2133.893	879.579	2136.421	879.617	2138.949	879.657	2141.478	879.698	2000	
1800	1904.105	791.413	1906.625	791.440	1909.146	791.469	1911.668	791.500	1914.191	791.532	1916.715	791.567	1919.241	791.603	1921.768	791.640	1924.295	791.679	1926.824	791.720	1929.354	791.762	1931.886	791.807	1934.419	791.852	1800	
1600	1693.477	659.589	1696.000	659.622	1698.526	659.657	1601.052	659.694	1603.579	659.733	1606.109	659.773	1608.639	659.817	1611.171	659.862	1613.705	659.908	1616.240	659.958	1618.776	660.009	1621.313	660.061	1623.852	660.116	1600	
1400	1282.864	527.786	1285.393	527.827	1287.924	527.871	1290.457	527.917	1292.991	527.966	1295.528	528.017	1298.066	528.071	1300.606	528.127	1303.148	528.186	1305.691	528.247	1308.236	528.311	1310.783	528.377	1313.332	528.446	1400	
1200	1075.803	439.939	1078.338	439.989	1080.875	440.041	1083.415	440.096	1085.957	440.155	1088.500	440.216	1091.046	440.281	1093.594	440.348	1096.143	440.419	1098.695	440.492	1101.249	440.569	1103.805	440.648	1106.363	440.730	1200	
1000	972.281	396.026	974.819	396.081	977.361	396.139	979.904	396.201	982.450	396.266	984.999	396.334	987.549	396.406	990.102	396.481	992.658	396.559	995.215	396.641	997.775	396.726	1000.337	396.814	1002.902	396.906	1000	
900	868.765	352.124	871.309	352.186	873.855	352.251	876.404	352.321	878.956	352.394	881.510	352.471	884.067	352.551	886.626	352.635	889.188	352.723	891.753	352.815	894.320	352.911	896.890	353.010	899.462	353.113	900	
800	765.260	308.237	767.811	308.308	770.364	308.383	772.919	308.462	775.478	308.545	778.040	308.633	780.605	308.725	783.173	308.822	785.743	308.922	788.316	309.027	790.893	309.136	793.472	309.250	796.055	309.367	800	
700	661.772	264.373	664.330	264.455	666.891	264.543	669.457	264.635	672.025	264.733	674.597	264.835	677.172	264.942	679.751	265.055	682.333	265.172	684.918	265.295	687.507	265.422	690.099	265.554	692.694	265.691	700	
600	558.308	220.545	560.877	220.644	563.451	220.749	566.029	220.860	568.611	220.977	571.196	221.100	573.786	221.228	576.380	221.363	578.978	221.504	581.580	221.651	584.185	221.804	586.795	221.963	589.409	222.127	600	
550	454.888	176.781	457.475	176.905	460.066	177.036	462.663	177.175	465.265	177.321	467.870	177.474	470.481	177.635	473.098	177.804	475.719	177.980	478.345	178.163	480.976	178.354	483.612	178.552	486.252	178.758	550	
500	413.541	159.306	416.136	159.443	418.737	159.589	421.344	159.743	423.956	159.905	426.574	160.075	429.197	160.254	431.825	160.441	434.459	160.637	437.098	160.840	439.743	161.052	442.393	161.272	445.048	161.501	500	100 (P)*
450	403.206	154.940	405.805	155.082	408.408	155.231	411.018	155.390	413.633	155.557	416.254	155.732	418.880	155.916	421.512	156.109	424.150	156.309	426.793	156.519	429.441	156.737	432.095	156.963	434.755	157.198	450	
400	351.555	133.146	354.169	133.310	356.789	133.485	359.416	133.669	362.049	133.864	364.689	134.068	367.335	134.283	369.988	134.507	372.647	134.741	375.312	134.986	377.984	135.240	380.661	135.504	383.345	135.778	400	
350	299.952	111.423	302.587	111.620	305.230	111.830	307.881	112.051	310.539	112.285	313.205	112.530	315.878	112.787	318.559	113.056	321.248	113.337	323.943	113.629	326.646	113.934	329.356	114.250	332.073	114.578	350	
330	279.331	102.765	281.977	102.979	284.632	103.207	287.295	103.448	289.966	103.701	292.645	103.968	295.332	104.247	298.028	104.539	300.731	104.844	303.442	105.162	306.160	105.492	308.887	105.836	311.621	106.192	330	
300	248.431	89.828	251.098	90.074	253.774	90.336	256.460	90.612	259.154	90.903	261.858	91.209	264.571	91.530	267.292	91.866	270.023	92.216	272.762	92.581	275.510	92.960	278.266	93.355	281.031	93.764	300	80 (P)*
270	217.587	76.978	220.281	77.268	222.986	77.575	225.701	77.900	228.426	78.242	231.162	78.601	233.908	78.978	236.664	79.372	239.430	79.783	242.206	80.211	244.991	80.656	247.786	81.119	250.591	81.598	270	
255	202.196	70.602	204.907	70.919	207.629	71.256	210.363	71.612	213.107	71.986	215.863	72.380	218.630	72.792	221.408	73.224	224.196	73.674	226.994	74.143	229.803	74.630	232.622	75.136	235.450	75.661	255	65 (P)*
225	171.506	58.004	174.262	58.397	177.030	58.813	179.813	59.253	182.608	59.716	185.416	60.202	188.236	60.711	191.069	61.243	193.913	61.798	196.769	62.375	199.637	62.976	202.516	63.599	205.406	64.245	225	
200	146.086	47.772	148.896	48.261	151.721	48.779	154.561	49.325	157.416	49.900	160.285	50.504	163.168	51.135	166.064	51.795	168.974	52.483	171.896	53.198	174.831	53.941	177.777	54.711	180.735	55.508	200	
180	135.982	43.795	138.820	44.337	141.674	44.910	144.544	45.515	147.429	46.152	150.329	46.819	153.244	47.517	156.173	48.247	159.115	49.006	162.069	49.796	165.036	50.616	168.015	51.465	171.006	52.344	180	50 (P)
160	125.932	39.920	128.803	40.527	131.691	41.169	134.596	41.847	137.517	42.558	140.453	43.305	143.404	44.085	146.369	44.899	149.347	45.747	152.338	46.627	155.341	47.541	158.355	48.487	161.380	49.465	160	50 (H)**
140	113.953	36.189	116.865	36.879	121.794	37.608	124.740	38.376	127.701	39.183	130.679	40.028	133.670	40.911	136.676	41.832	139.694	42.789	142.724	43.783	145.765	44.812	148.816	45.877	151.876	46.976	140	
120	106.076	32.671	109.034	33.468	112.010	34.310	115.003	35.196	118.012	36.126	121.035	37.098	124.072	38.113	127.120	39.169	130.180	40.265	133.249	41.402	136.326	42.577	139.411	43.791	142.502	45.042	120	
100	101.186	31.025	104.171	31.889	107.173	32.801	110.192	33.760	113.223	34.765	116.272	35.815	119.331	36.910	122.401	38.048	125.480	39.229	128.566	40.451	131.658	41.714	134.756	43.016	137.856	44.356	100	
90	96.336	29.482	99.350	30.425	102.379	31.418	105.425	32.462	108.483	33.555	111.553	34.695	114.633	35.882	117.721	37.114	120.815	38.391	123.914	39.710	127.016	41.071	130.119	42.472	133.222	43.911	90	40 (H)**
80	91.334	28.074	94.377	29.109	97.635	30.199	100.705	31.342	103.787	32.537	106.877	33.781	109.973	35.075	113.074	36.415	116.176	37.800	119.279	39.229	122.380	40.700	125.476	42.211	128.567	43.760	80	35 (P)*
70	86.786	26.844	89.858	27.990	92.941	29.194	96.033	30.454	99.131	31.768	102.234	33.134	105.337	34.549	108.438	36.012	111.535	37.521	114.624	39.072							70	30 (H)**
65	82.096	25.855	85.190	27.134	88.291	28.474	91.394	29.872	94.496	31.326	97.593	32.831															65	
60	80.234	25.546	83.334	26.886	86.437	28.288	89.539	29.747	92.635	31.262																	60	30 (P)*
55	77.451	25.200	80.553	26.640	83.651	28.141																					55	
50																											50	30 (H)**
45																											45	
40																											40	25 (P)*
35																											35	
30																											30	20 (H)**
25																											25	
23																											23	20 (P)*
20																											20	15 (H)**
15																											15	10 (P)*
14																											14	10 (H)**

*P= Plain & Rolling Terrain **H= Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 93 Degrees

Δ = 93°

Rc	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		Rc	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	2641.950	1131.852	2644.454	1131.856	2646.958	1131.862	2649.462	1131.869	2651.968	1131.877	2654.475	1131.885	2656.982	1131.896	2659.491	1131.907	2662.000	1131.920	2664.510	1131.934	2667.021	1131.949	2669.532	1131.966	2672.045	1131.983	2500	
2200	2325.817	996.031	2328.321	996.036	2330.825	996.042	2333.331	996.050	2335.837	996.059	2338.345	996.069	2340.854	996.081	2343.363	996.094	2345.873	996.109	2348.385	996.124	2350.897	996.142	2353.411	996.160	2355.925	996.180	2200	
2000	2115.062	905.484	2117.566	905.490	2120.071	905.496	2122.577	905.505	2125.084	905.515	2127.593	905.526	2130.102	905.539	2132.612	905.553	2135.124	905.569	2137.636	905.586	2140.150	905.605	2142.665	905.626	2145.180	905.648	2000	
1800	1904.307	814.937	1906.811	814.943	1909.317	814.951	1911.823	814.960	1914.331	814.971	1916.841	814.984	1919.351	814.998	1921.862	815.014	1924.375	815.031	1926.889	815.051	1929.405	815.072	1931.921	815.095	1934.438	815.119	1800	
1500	1588.175	679.117	1590.680	679.125	1593.186	679.133	1595.694	679.144	1598.204	679.157	1600.715	679.173	1603.227	679.190	1605.741	679.209	1608.256	679.230	1610.773	679.254	1613.291	679.279	1615.811	679.306	1618.332	679.335	1500	
1200	1272.043	543.298	1274.549	543.307	1277.057	543.318	1279.567	543.332	1282.079	543.348	1284.593	543.367	1287.108	543.389	1289.626	543.413	1292.145	543.439	1294.665	543.468	1297.188	543.500	1299.713	543.534	1302.239	543.570	1200	
1000	1061.288	452.752	1063.796	452.763	1066.306	452.777	1068.818	452.793	1071.332	452.813	1073.849	452.836	1076.367	452.862	1078.888	452.890	1081.411	452.922	1083.936	452.957	1086.463	452.994	1088.992	453.035	1091.524	453.079	1000	
900	955.912	407.480	958.420	407.492	960.931	407.507	963.445	407.526	965.960	407.547	968.479	407.572	970.999	407.601	973.522	407.633	976.048	407.668	978.575	407.707	981.105	407.749	983.638	407.794	986.173	407.843	900	
800	850.535	362.208	853.045	362.221	855.557	362.238	858.072	362.259	860.590	362.284	863.110	362.312	865.634	362.344	868.159	362.380	870.688	362.420	873.219	362.463	875.753	362.510	878.290	362.562	880.829	362.617	800	
700	745.159	316.937	747.670	316.952	750.184	316.971	752.701	316.995	755.222	317.023	757.745	317.055	760.271	317.092	762.801	317.133	765.333	317.178	767.869	317.229	770.408	317.282	772.949	317.341	775.494	317.403	700	100 (P)*
600	639.784	271.666	642.297	271.684	644.813	271.706	647.333	271.734	649.856	271.767	652.384	271.805	654.914	271.848	657.449	271.896	659.987	271.948	662.528	272.006	665.073	272.070	667.622	272.138	670.174	272.211	600	
500	534.409	226.397	536.924	226.418	539.444	226.445	541.968	226.478	544.496	226.518	547.029	226.563	549.566	226.615	552.107	226.672	554.652	226.735	557.202	226.805	559.756	226.881	562.314	226.962	564.876	227.050	500	
480	429.036	181.130	431.555	181.156	434.080	181.190	436.610	181.232	439.145	181.281	441.686	181.338	444.231	181.402	446.783	181.474	449.339	181.553	451.901	181.640	454.468	181.735	457.040	181.837	459.618	181.946	480	
460	386.888	163.024	389.409	163.053	391.936	163.091	394.469	163.137	397.008	163.192	399.553	163.255	402.104	163.326	404.661	163.406	407.224	163.495	409.792	163.591	412.367	163.696	414.947	163.810	417.532	163.931	460	
440	376.351	158.498	378.873	158.528	381.400	158.567	383.935	158.614	386.475	158.670	389.021	158.735	391.573	158.809	394.132	158.891	396.696	158.982	399.267	159.081	401.843	159.189	404.425	159.305	407.014	159.431	440	
420	323.666	135.867	326.192	135.903	328.724	135.948	331.264	136.003	333.811	136.069	336.365	136.144	338.926	136.230	341.494	136.326	344.068	136.432	346.650	136.548	349.239	136.674	351.834	136.810	354.437	136.956	420	
400	270.984	113.239	273.514	113.281	276.053	113.336	278.601	113.403	281.157	113.481	283.721	113.572	286.294	113.675	288.875	113.790	291.465	113.917	294.062	114.056	296.668	114.207	299.282	114.370	301.904	114.546	400	80 (P)*
380	249.912	104.189	252.445	104.235	254.987	104.294	257.539	104.367	260.100	104.452	262.669	104.551	265.248	104.663	267.836	104.788	270.433	104.928	273.039	105.077	275.654	105.241	278.277	105.418	280.909	105.609	380	
360	218.305	90.616	220.843	90.669	223.391	90.737	225.950	90.820	228.520	90.918	231.100	91.032	233.691	91.160	236.291	91.304	238.902	91.463	241.523	91.636	244.154	91.825	246.795	92.029	249.445	92.248	360	
340	186.700	77.046	189.245	77.108	191.801	77.188	194.371	77.286	196.952	77.402	199.546	77.535	202.152	77.686	204.770	77.855	207.399	78.042	210.040	78.246	212.693	78.468	215.357	78.706	218.032	78.963	340	65 (P)*
325	170.899	70.262	173.448	70.331	176.010	70.419	178.586	70.526	181.175	70.653	183.778	70.799	186.393	70.965	189.022	71.150	191.663	71.355	194.317	71.579	196.983	71.822	199.662	72.085	202.353	72.367	325	
310	159.300	66.701	161.861	66.786	164.438	66.895	167.031	67.028	169.641	67.185	172.267	67.366	174.909	67.572	177.566	67.801	180.239	68.055	182.927	68.332	185.630	68.633	188.347	68.959	191.080	69.307	310	
295	142.975	59.810	145.550	59.816	118.146	59.652	120.761	59.818	123.397	60.013	126.053	60.241	128.727	60.497	131.421	60.784	134.133	61.100	136.864	61.446	139.612	61.822	142.378	62.227	145.160	62.662	295	
280	126.975	53.110	129.550	53.116	132.126	53.143	134.703	53.189	137.281	53.255	139.860	53.341	142.440	53.447	145.021	53.573	147.603	53.719	150.186	53.885	152.770	54.071	155.355	54.277	157.941	54.503	280	
265	110.975	46.410	113.550	46.416	116.126	46.443	118.703	46.489	121.281	46.555	123.860	46.641	126.440	46.747	129.021	46.873	131.603	47.019	134.186	47.185	136.770	47.371	139.355	47.577	141.941	47.803	265	
250	94.975	39.710	97.550	39.716	100.126	39.743	102.703	39.789	105.281	39.855	107.860	39.941	110.440	40.047	113.021	40.173	115.603	40.319	118.186	40.485	120.770	40.671	123.355	40.877	125.941	41.103	250	
235	78.975	33.010	81.550	33.016	84.126	33.043	86.703	33.089	89.281	33.155	91.860	33.241	94.440	33.347	97.021	33.473	99.603	33.619	102.186	33.785	104.770	33.971	107.355	34.177	109.941	34.403	235	
220	62.975	26.310	65.550	26.316	68.126	26.343	70.703	26.389	73.281	26.455	75.860	26.541	78.440	26.647	81.021	26.773	83.603	26.919	86.186	27.085	88.770	27.271	91.355	27.477	93.941	27.703	220	
205	46.975	19.610	49.550	19.616	52.126	19.643	54.703	19.689	57.281	19.755	59.860	19.841	62.440	19.947	65.021	20.073	67.603	20.219	70.186	20.385	72.770	20.571	75.355	20.777	77.941	21.003	205	
190	30.975	12.910	33.550	12.916	36.126	12.943	38.703	12.989	41.281	13.055	43.860	13.141	46.440	13.247	49.021	13.373	51.603	13.519	54.186	13.685	56.770	13.871	59.355	14.077	61.941	14.303	190	
175	14.975	6.210	17.550	6.216	20.126	6.243	22.703	6.289	25.281	6.355	27.860	6.441	30.440	6.547	33.021	6.673	35.603	6.819	38.186	6.985	40.770	7.171	43.355	7.377	45.941	7.603	175	
160			1.550	0.516	4.126	0.543	6.703	0.589	9.281	0.655	11.860	0.741	14.440	0.847	17.021	0.973	19.603	1.119	22.186	1.285	24.770	1.471	27.355	1.677	29.941	1.903	160	
145																											145	
130																											130	
115																											115	
100																											100	
90																											90	
80																											80	
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20																											20	
15																											15	
14																											14	

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 93 Degrees

△=93°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2674.559	1132.002	2677.073	1132.022	2679.588	1132.043	2682.104	1132.065	2684.622	1132.089	2687.140	1132.114	2689.658	1132.140	2692.178	1132.167	2694.698	1132.196	2697.220	1132.225	2699.742	1132.256	2702.265	1132.288	2704.789	1132.322	2500	
2200	2358.440	996.201	2360.957	996.224	2363.474	996.248	2365.992	996.273	5368.512	996.301	2371.032	996.329	2373.553	996.358	2376.076	996.389	2378.599	996.421	2381.123	996.455	2383.648	996.490	2386.175	996.527	2388.702	996.564	2200	
2000	2147.697	905.671	2150.215	905.696	2152.734	905.723	2155.254	905.751	2157.776	905.780	2160.298	905.811	2162.822	905.844	2165.346	905.878	2167.872	905.913	2170.398	905.950	2172.926	905.989	2175.455	906.029	2177.985	906.071	2000	
1800	1936.957	815.145	1939.477	815.173	1941.998	815.202	1944.521	815.233	1947.044	815.266	1949.569	815.300	1952.095	815.337	1954.622	815.375	1957.151	815.414	1959.680	815.455	1962.211	815.498	1964.743	815.543	1967.276	815.589	1800	
1500	1620.854	679.366	1623.378	679.400	1625.904	679.435	1628.431	679.472	1630.959	679.512	1633.488	679.553	1636.020	679.596	1638.552	679.642	1641.086	679.689	1643.622	679.739	1646.158	679.790	1648.697	679.843	1651.237	679.899	1500	
1200	1304.767	543.609	1307.297	543.651	1309.829	543.695	1312.362	543.741	1314.897	543.791	1317.434	543.843	1319.973	543.897	1322.514	543.954	1325.056	544.013	1327.600	544.075	1330.146	544.139	1332.694	544.206	1335.244	544.275	1200	
1000	1094.057	453.126	1096.594	453.176	1099.131	453.229	1101.671	453.285	1104.214	453.344	1106.758	453.406	1109.304	453.471	1111.853	453.539	1114.404	453.610	1116.957	453.684	1119.511	453.762	1122.069	453.842	1124.627	453.925	1000	
900	988.710	407.896	991.250	407.951	993.792	408.010	996.337	408.072	998.884	408.137	1001.433	408.206	1003.984	408.279	1006.538	408.354	1009.094	408.433	1011.653	408.515	1014.214	408.601	1016.777	408.690	1019.343	408.783	900	
800	883.371	362.675	885.916	362.738	888.463	362.804	891.012	362.874	893.565	362.948	896.120	363.025	898.678	363.106	901.239	363.192	903.802	363.280	906.368	363.373	908.936	363.469	911.507	363.570	914.081	363.674	800	
700	778.042	317.470	780.593	317.542	783.147	317.618	785.704	317.698	788.264	317.782	790.827	317.870	793.393	317.963	795.962	318.061	798.533	318.162	801.108	318.268	803.686	318.378	806.267	318.493	808.851	318.611	700	
600	672.729	272.289	675.289	272.372	677.851	272.460	680.417	272.554	682.987	272.652	685.560	272.755	688.137	272.864	690.717	272.977	693.301	273.096	695.887	273.219	698.478	273.347	701.072	273.481	703.669	273.619	600	
500	567.443	227.144	570.013	227.244	572.588	227.350	575.167	227.462	577.750	227.580	580.338	227.704	582.929	227.833	585.525	227.970	588.125	228.112	590.728	228.260	593.336	228.414	595.948	228.574	598.563	228.740	500	
400	462.200	182.064	464.788	182.188	467.381	182.321	469.979	182.461	472.582	182.608	475.191	182.763	477.804	182.925	480.423	183.095	483.046	183.273	485.674	183.458	488.308	183 651	490.946	183.851	493 589	184.058	400	
360	420.124	164.062	422.721	164.200	425.324	164.347	427.933	164.502	430.547	164.666	433.167	164.838	435.792	165.019	438.423	165.208	441.060	165.405	443.701	165.610	446.349	165.824	449.001	166.046	451.659	166.277	360	100 (P)*
350	409.608	159.565	412.208	159.707	414.813	159.858	417.425	160.018	420.042	160.187	422.665	160.364	425.294	160.549	427.928	160.744	430.568	160.946	433.214	161.158	435.865	161.378	438.522	161.606	441.185	161.844	350	
300	357.046	137.112	359.662	137.278	362.284	137.455	364.914	137.641	367.550	137.837	370.192	138.044	372.841	138.260	375.496	138.487	378.158	138.723	380.826	138 969	383.501	139.226	386.182	139.492	388.870	139.769	300	
250	304.533	114.733	307.171	114.932	309.817	115.144	312.470	115.367	315.132	115.603	317.801	115.850	320.478	116.109	323.162	116.381	325.854	116.664	328.553	116.959	331.260	117.267	333.974	117.586	336.695	117.917	250	
230	283.549	105.813	286.198	106.029	288.856	106.259	291.522	106.501	294.196	106.757	296.879	107.026	299.570	107.308	302.269	107.603	304.976	107.910	307.691	108.231	310.414	108.565	313.144	108.912	315.883	109.271	230	80 (P)*
200	252.105	92.482	254.775	92.731	257.455	92.995	260.144	93.274	262.842	93.568	265.550	95.876	268.267	94.200	270.992	94.539	273.727	94 892	276.471	95.260	279.224	95.643	281.985	96.041	284.755	96.454	200	
170	220.718	79.240	223.416	79.532	226.124	79.842	228.844	80.170	231.573	80.515	234.314	80.878	237.065	81.258	239.826	81.655	242.597	82.070	245.378	82.502	248.169	82.952	250.970	83.418	253.780	83.902	170	
155	205.056	72.668	207.771	72.988	210.497	73.328	213.235	73.687	215.985	74.065	218.746	74.462	221.518	74.879	224.301	75.314	227.095	75.768	229.899	76.241	232.714	76.733	235.539	77.244	238.374	77.773	155	65 (P)*
125	173.826	59.680	176.587	60.077	179.361	60.497	182.148	60.940	184.949	61.407	187.763	61.898	190.590	62.411	193.430	62.948	196.281	63.508	199.145	64.091	202.020	64.698	204.907	65.326	207.805	65.978	125	
100	147.960	49.126	150.775	49.619	153.607	50.142	156.454	50.693	159.316	51.273	162.193	51.882	165.084	52.519	167.989	53.185	170.907	53 879	173.838	54.601	176.783	55.351	179.739	56.128	182.707	56.932	100	
90	137.679	45.021	140.523	45.567	143.384	46.146	146.262	46.756	149.155	47.398	152.064	48.072	154.987	48.777	157.925	49.513	160 877	50.279	163.842	51.076	166.819	51.903	169.809	52.761	172.810	53.648	90	50 (P)
80	127.453	41.019	130.331	41.631	133.228	42.279	136.141	42.962	139.071	43.681	142.016	44.434	144.977	45.221	147.952	46.043	150.941	46.898	153.943	47.787	156.958	48.709	159.984	49.663	163.021	50.650	80	50 (H)**
70	117.301	37.162	120.220	37.858	123.158	38.594	126.113	39.369	129.086	40.183	132.074	41.036	135.076	41.927	138.094	42.856	141.124	43.822	144.166	44.825	147.220	45.864	150.285	46.938	153.359	48.048	70	
60	107.251	33.519	110.219	34.324	113.206	35.174	116.210	36.068	119.230	37.006	122.266	37.988	125.315	39.011	128.377	40.077	131.451	41.184	134.534	42.331	137.627	43.517	140.727	44.741	143.834	46.004	60	40 (P)*
55	102.277	31.813	105.272	32.685	108.286	33.605	111.317	34.573	115.363	35.587	117.424	36.647	120.496	37.752	123.580	38.900	126.674	40.092	129.776	41.325	132.885	42.599	135.998	43.913	139.116	45.266	55	
50	97.344	30.210	100.369	31.161	103.412	32.164	106.470	33.217	109.542	34.320	112.627	35.471	115.722	36.668	118.825	37.912	121.936	39.200	125.052	40.531	128.171	41.905	131.292	43.319	134.412	44.771	50	40 (H)**
45	92.461	28.743	95.516	29.788	98.588	30.888	101.673	32.041	104.770	33.247	107.875	34.503	110.988	35.808	114.106	37.160	117.226	38.559	120.347	40.001	123.466	41.485	126.582	43.010	129.692	44.573	45	35 (P)*
40	87.634	27.456	90.720	28.613	93.818	29.828	96.926	31.099	100.041	32.423	103.161	33.804	106.282	35.232	109.401	36.709	112.517	38.231	115.627	39.796							40	30 (H)**
35	82.867	26.412	85.978	27.703	89.096	29.056	92.216	30.467	95.336	31.933	98.453	33.452															35	
33	80.976	26.083	84.093	27.435	87.214	28.849	90.334	30.322	93.449	31.850																	33	30 (P)*
30	78.151	25.706	81.271	27.158	84.388	28.673																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 94 Degrees

$\Delta = 94°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	2688.421	1165.700	2690.924	1165.705	2693.428	1165.711	2695.933	1165.717	2698.439	1165.725	2700.945	1165.734	2703.453	1165.745	2705.962	1165.756	2708.471	1165.769	2710.981	1165.783	2713.492	1165.798	2716.004	1165.815	2718.517	1165.833	2500	
2200	2366.711	1025.818	2369.215	1025.823	2371.719	1025.829	2374.225	1025.837	2376.732	1025.846	2379.239	1025.836	2381.748	1025.868	2384.258	1025.881	2386.768	1025.896	2389.280	1025.912	2391.792	1025.929	2394.306	1025.948	2396.821	1025.968	2200	
2000	2152.238	932.563	2154.742	932.568	2157.247	932.575	2159.754	932.584	2162.261	932.594	2164.769	932.605	2167.279	932.618	2169.789	932.632	2172.301	932.648	2174.813	932.666	2177.328	932.685	2179.843	932.706	2182.359	932.728	2000	
1800	1937.766	839.308	1940.270	839.314	1942.776	839.322	1945.282	839.331	1947.791	839.342	1950.300	839.355	1952.810	839.369	1955.322	839.385	1957.835	839.403	1960.349	839.423	1962.865	839.444	1965.381	839.467	1967.899	839.491	1800	
1500	1616.057	699.427	1618.562	699.434	1621.069	699.443	1623.577	699.454	1626.086	699.467	1628.598	699.482	1631.110	699.500	1633.624	699.519	1636.140	699.540	1638.657	699.564	1641.176	699.589	1643.695	699.617	1646.217	699.646	1500	
1200	1294.348	559.545	1296.855	559.554	1299.363	559.565	1301.874	559.580	1304.385	559.596	1306.899	559.615	1309.415	559.637	1311.933	559.661	1314.452	559.688	1316.973	559.717	1319.497	559.749	1322.021	559.783	1324.548	559.820	1200	
1000	1079.87	466.292	1082.385	466.302	1084.895	466.316	1087.407	466.333	1089.921	466.353	1092.438	466.376	1094.957	466.402	1097.478	466.431	1100.001	466.463	1102.526	466.498	1105.054	466.536	1107.584	466.577	1110.116	466.622	1000	
900	972.641	419.666	975.150	419.677	977.661	419.693	980.175	419.711	982.690	419.733	985.209	419.759	987.730	419.788	990.253	419.820	992.780	419.856	995.308	419.895	997.838	419.937	1000.372	419.983	1002.907	420.032	900	
800	865.406	373.040	867.916	373.052	870.428	373.070	872.943	373.091	875.461	373.116	877.982	373.145	880.506	373.177	883.032	373.213	885.561	373.253	888.093	373.297	890.627	373.345	893.165	373.396	895.705	373.452	800	
700	758.171	326.414	760.682	326.430	763.196	326.449	765.714	326.473	768.235	326.502	770.758	326.534	773.285	326.572	775.815	326.613	778.348	326.658	780.885	326.709	783.424	326.763	785.967	326.823	788.512	326.885	700	100 (P)*
650	650.917	279.790	653.450	279.808	655.966	279.831	658.487	279.858	661.011	279.891	663.538	279.930	666.070	279.973	668.605	280.021	671.143	280.073	673.686	280.133	676.231	280.197	678.781	280.266	681.334	280.340	650	
600	543.704	233.167	546.219	233.188	548.739	233.215	551.263	233.249	553.792	233.289	556.325	233.334	558.863	233.386	561.405	233.444	563.951	233.509	566.501	233.579	569.056	233.655	571.615	233.738	574.179	233.826	600	
550	436.472	186.546	438.991	186.573	441.516	186.607	444.046	186.649	446.582	186.698	449.124	186.756	451.670	186.821	454.223	186.893	456.780	186.973	459.343	187.061	461.911	187.156	464.485	187.260	467.064	187.370	550	
500	393.580	167.898	396.102	167.928	398.629	167.966	401.163	168.011	403.703	168.068	406.249	168.131	408.801	168.204	411.358	168.284	413.922	168.374	416.492	168.471	419.067	168.577	421.649	168.691	424.236	168.814	500	
450	382.857	163.237	385.379	163.267	387.908	163.306	390.442	163.354	392.983	163.411	395.530	163.477	398.083	163.551	400.643	163.634	403.209	163.725	405.781	163.826	408.358	163.935	410.942	164.052	413.532	164.179	450	
400	329.243	139.929	331.769	139.965	334.302	140.011	336.843	140.067	339.391	140.133	341.945	140.209	344.508	140.296	347.076	140.393	349.653	140.499	352.236	140.616	354.826	140.744	357.424	140.881	360.028	141.028	400	80 (P)*
350	275.632	116.625	278.163	116.667	280.702	116.722	283.251	116.790	285.808	116.869	288.374	116.960	290.948	117.064	293.530	117.180	296.121	117.308	298.720	117.449	301.328	117.601	303.944	117.766	306.568	117.943	350	
330	254.188	107.504	256.721	107.550	259.265	107.410	261.817	107.483	264.379	107.569	266.950	107.669	269.531	107.782	272.120	107.908	274.719	108.047	277.326	108.200	279.943	108.365	282.569	108.544	285.203	108.737	330	
300	222.023	93.324	224.562	93.378	227.111	93.447	229.672	93.531	232.242	93.630	234.824	93.744	237.416	93.874	240.019	94.019	242.631	94.179	245.254	94.354	247.888	94.545	250.531	94.751	253.185	94.972	300	
270	189.861	79.348	192.406	79.411	194.964	79.492	197.535	79.591	200.118	79.707	202.713	79.842	205.321	79.995	207.941	80.165	210.573	80.353	213.216	80.560	215.872	80.784	218.539	81.026	221.217	81.285	270	65 (P)*
250	173.781	72.362	176.331	72.431	178.894	72.519	181.472	72.628	184.062	72.756	186.667	72.903	189.284	73.071	191.915	73.258	194.559	73.464	197.216	73.690	199.885	73.936	202.567	74.201	205.262	74.486	250	
230	161.625	58.395	144.187	58.480	146.765	58.590	149.360	58.724	151.972	58.883	154.600	59.066	157.245	59.273	159.905	59.505	162.581	59.761	165.273	60.041	167.979	60.345	170.701	60.673	173.438	61.025	230	
200	114.836	46.765	117.412	46.872	120.009	47.009	122.627	47.177	125.266	47.375	127.924	47.604	130.602	47.863	133.299	48.152	136.015	48.471	138.750	48.820	141.503	49.199	144.274	49.608	147.062	50.047	200	
180	104.123	42.118	106.707	42.236	109.315	42.389	111.946	42.575	114.598	42.795	117.273	43.049	119.969	43.337	122.687	43.657	125.424	44.012	128.182	44.399	130.960	44.820	133.757	45.273	136.572	45.760	180	50 (P)*
160	93.413	37.474	96.007	37.608	98.628	37.779	101.274	37.989	103.944	38.236	106.639	38.521	109.358	38.844	112.100	39.205	114.864	39.603	117.650	40.038	120.457	40.510	123.285	41.019	126.133	41.564	160	50 (H)**
150	87.706	32.836	90.314	32.988	87.951	33.184	90.616	33.424	93.309	33.706	96.030	34.032	98.776	34.400	101.548	34.812	104.345	35.265	107.166	35.761	110.010	36.299	112.876	36.878	115.764	37.499	150	
140	72.006	28.206	74.630	28.304	77.289	28.612	79.980	28.891	82.702	29.220	85.455	29.599	88.237	30.028	91.048	30.507	93.886	31.034	96.751	31.610	99.640	32.234	102.554	32.906	105.490	33.625	140	40 (P)*
130	66.658	25.891	69.294	26.089	71.965	26.338	74.672	26.642	77.413	27.001	80.186	27.414	82.991	27.881	85.825	28.402	88.688	28.976	91.579	29.602	94.495	30.280	97.437	31.010	100.401	31.791	130	
120	61.314	23.589	63.962	23.802	66.650	24.076	69.375	24.410	72.137	24.804	74.934	25.258	77.764	25.770	80.626	26.342	83.518	26.970	86.438	27.657	89.385	28.399	92.357	29.198	95.353	30.051	120	
110	55.973	21.288	58.637	21.525	61.343	21.829	64.091	22.200	66.878	22.637	69.703	23.140	72.563	23.707	75.457	24.340	78.382	25.035	81.336	25.795	84.317	26.613	87.324	27.493	90.354	28.433	110	35 (P)*
100	50.637	18.994	53.320	19.261	56.050	19.602	58.825	20.019	61.643	20.509	64.501	21.073	67.396	21.709	70.327	22.417	73.290	23.194	76.282	24.041	79.302	24.954	82.346	25.934	85.412	26.978	100	35 (H) 30 (P)*
90	45.308	16.712	48.015	17.016	50.774	17.406	53.583	17.880	56.438	18.439	59.336	19.080	62.274	19.803	65.248	20.605	68.254	21.485	71.290	22.441	74.351	23.472	77.435	24.574	80.536	25.746	90	
80	43.179	15.803	45.897	16.125	48.670	16.538	51.495	17.041	54.367	17.632	57.284	18.311	60.241	19.075	63.234	19.922	66.259	20.851	69.313	21.859	72.392	22.944	75.490	24.103	78.605	25.334	80	
70	39.990	14.446	42.727	14.800	45.524	15.233	48.375	15.803	51.277	16.453	54.224	17.196	57.212	18.030	60.236	18.955	63.291	19.967	66.373	21.063	69.476	22.241	72.595	23.496	73.726	24.825	70	30 (H)**
60	34.681	12.505	37.467	12.629	40.313	13.171	43.219	13.828	46.179	14.599	49.185	15.479	52.231	16.465	55.311	17.553	58.415	18.738	61.539	20.016	64.673	21.381	67.812	22.827	70.949	24.350	60	
50	32.573	11.320	35.374	11.780	38.244	12.367	41.176	13.079	44.163	13.912	47.197	14.862	50.268	15.923	53.368	17.092	56.490	18.362	59.625	19.727	62.764	21.180	65.899	22.715			50	25 (P)*
40	29.412	10.009	32.250	10.537	35.163	11.208	38.141	12.020	41.173	12.967	44.248	14.042	47.356	15.239	50.484	16.550	53.622	17.967	56.779	19.480							40	25 (H)**
30	24.188	7.902	27.112	8.598	30.118	9.478	33.186	10.532	36.298	11.748	39.432	13.112	42.569	14.610													30	20 (P)*
25	23.153	7.500	26.099	8.242	29.127	9.179	32.215	10.298	35.339	11.585	38.477	13.023															25	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 94 Degrees

$\Delta = 94°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s'	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2721.031	1165.852	2723.545	1165.872	2726.061	1165.893	2728.578	1165.916	2731.095	1165.940	2733.613	1165.965	2736.132	1165.991	2738.652	1166.019	2741.173	1166.047	2743.695	1166.077	2746.218	1166.108	2748.741	1166.141	2751.265	1166.174	2500	
2200	2399.336	1025.989	2401.853	1026.012	2404.370	1026.037	2406.889	1026.062	2409.409	1026.090	2411.930	1026.118	2414.451	1026.148	2416.974	1026.179	2419.498	1026.212	2422.022	1026.246	2424.548	1026.281	2427.075	1026.318	2429.602	1026.356	2200	
2000	2184.876	932.752	2187.394	932.777	2189.914	932.803	2192.434	932.832	2194.956	932.862	2197.479	932.893	2200.002	932.926	2202.527	932.960	2205.053	932.996	2207.581	933.033	2210.109	933.072	2212.638	933.113	2215.168	933.155	2000	
1800	1970.418	839.518	1972.939	839.546	1975.460	839.575	1977.983	839.607	1980.507	839.640	1983.032	839.675	1985.559	839.711	1988.086	839.750	1990.615	839.789	1993.145	839.831	1995.677	839.874	1998.209	839.919	2000.743	839.966	1800	
1500	1648.740	699.678	1651.264	699.711	1653.790	699.747	1656.317	699.785	1658.846	699.824	1661.376	699.686	1663.908	699.910	1666.441	699.866	1668.976	700.003	1671.512	700.054	1674.049	700.105	1676.588	700.159	1679.129	700.215	1500	
1200	1327.077	559.859	1329.607	559.902	1332.139	559.946	1334.674	559.993	1337.209	560.043	1339.747	560.095	1342.287	560.150	1344.828	560.207	1347.371	560.267	1349.916	560.329	1352.463	560.394	1355.011	560.462	1357.562	560.531	1200	
1000	1112.650	466.669	1115.187	466.719	1117.726	466.773	1120.266	466.829	1122.810	466.889	1125.354	466.951	1127.902	467.017	1130.451	467.086	1133.003	467.158	1135.557	467.232	1138.113	467.311	1140.671	467.391	1143.231	467.475	1000	
900	1005.445	420.085	1007.986	420.141	1010.529	420.200	1013.073	420.263	1015.621	420.329	1018.171	420.398	1020.724	420.471	1023.279	420.548	1025.836	420.627	1028.396	420.711	1030.958	420.797	1033.522	420.887	1036.089	420.980	900	
800	898.247	373.511	900.793	373.574	903.341	373.641	905.892	373.712	908.445	373.786	911.001	373.865	913.561	373.946	916.122	374.032	918.686	374.122	921.253	374.216	923.823	374.312	926.395	374.414	928.970	374.519	800	
700	791.061	326.953	793.613	327.025	796.168	327.102	798.725	327.182	801.286	327.267	803.850	327.356	806.417	327.450	808.988	327.549	811.561	327.651	814.137	327.758	816.717	327.869	819.299	327.985	821.884	328.105	700	
600	683.891	280.418	686.451	280.502	689.015	280.592	691.582	280.686	694.153	280.785	696.727	280.889	699.305	280.999	701.887	281.113	704.472	281.233	707.061	281.357	709.653	281.487	712.248	281.622	714.847	281.761	600	
500	576.747	233.921	579.318	234.021	581.895	234.128	584.476	234.242	587.060	234.360	589.649	234.486	592.242	234.617	594.839	234.754	597.441	234.898	600.046	235.047	602.656	235.203	605.270	235.365	607.888	235.532	500	
400	469.648	187.489	472.238	187.614	474.832	187.748	477.432	187.889	480.037	188.038	482.647	188.194	485.263	188.358	487.884	188.530	490.509	188.709	493.140	188.896	495.776	189.090	498.417	189.292	501.062	189.502	400	
360	426.830	168.946	429.428	169.085	432.033	169.234	434.644	169.391	437.260	169.556	439.882	169.730	442.510	169.912	445.143	170.103	447.782	170.302	450.427	170.509	453.077	170.725	455.732	170.949	458.393	171.182	360	
350	416.128	164.314	418.729	164.458	421.337	164.610	423.951	164.772	426.570	164.942	429.196	165.120	431.827	165.308	434.463	165.504	437.106	165.708	439.754	165.922	442.409	166.144	445.068	166.374	447.734	166.614	350	
300	362.639	141.186	365.257	141.354	367.882	141.531	370.513	141.720	373.152	141.918	375.797	142.126	378.448	142.344	381.107	142.573	383.772	142.812	386.443	143.061	389.121	143.319	391.806	143.588	394.497	143.867	300	
250	309.200	118.132	311.841	118.333	314.489	118.547	317.146	118.772	319.810	119.010	322.482	119.260	325.162	119.521	327.850	119.795	330.545	120.081	333.248	120.379	335.959	120.690	338.677	121.012	341.402	121.346	250	
230	287.846	108.942	290.498	109.161	293.158	109.393	295.828	109.638	298.505	109.896	301.191	110.167	303.885	110.451	306.588	110.749	309.299	111.060	312.018	111.384	314.745	111.720	317.481	112.070	320.224	112.433	230	
200	255.848	95.208	258.521	95.459	261.204	95.726	263.896	96.007	266.598	96.303	269.310	96.615	272.031	96.942	274.761	97.284	277.500	97.640	280.249	98.012	283.007	98.399	285.773	98.800	288.548	99.217	200	
170	223.907	81.563	226.669	81.858	229.321	82.171	232.044	82.502	234.779	82.850	237.524	83.216	240.279	83.600	243.046	84.001	245.822	84.419	248.609	84.856	251.406	85.309	254.212	85.780	257.029	86.269	170	
155	207.969	74.790	210.688	75.113	213.419	75.456	216.161	75.818	218.916	76.200	221.682	76.601	224.459	77.021	227.248	77.460	230.047	77.919	232.858	78.396	235.679	78.893	238.511	79.408	241.353	79.943	155	65 (P)*
125	176.189	61.401	178.955	61.802	181.734	62.225	184.528	62.673	187.335	63.145	190.155	63.640	192.988	64.158	195.834	64.700	198.693	65.265	201.564	65.854	204.447	66.465	207.342	67.100	210.249	67.758	125	
100	149.868	50.516	152.690	51.014	155.528	51.541	158.382	52.097	161.251	52.683	164.136	53.298	167.035	53.941	169.949	54.613	172.876	55.313	175.817	56.042	178.770	56.798	181.736	57.583	184.715	58.395	100	
90	139.406	46.279	142.238	46.831	145.126	47.415	148.012	48.031	150.913	48.679	153.831	49.359	156.763	50.070	159.710	50.813	162.672	51.587	165.647	52.391	168.635	53.226	171.635	54.091	174.648	54.986	90	50 (P)
80	129.001	42.146	131.888	42.765	134.792	43.419	137.714	44.108	140.653	44.833	143.609	45.594	146.579	46.388	149.565	47.218	152.565	48.081	155.578	48.978	158.605	49.908	161.643	50.872	164.693	51.868	80	50 (H)**
70	118.672	38.161	121.600	38.863	124.548	39.606	127.513	40.388	130.495	41.210	133.494	42.071	136.509	42.970	139.538	43.908	142.580	44.883	145.636	45.895	148.703	46.944	151.781	48.028	154.870	49.148	70	
60	108.448	34.391	111.426	35.203	114.424	36.061	117.439	36.963	120.472	37.910	123.520	38.901	126.582	39.934	129.658	41.010	132.745	42.127	135.844	43.284	138.951	44.481	142.067	45.718	145.190	46.992	60	40 (P)*
55	103.367	32.622	106.394	33.502	109.420	34.431	112.463	35.408	115.522	36.431	118.596	37.501	121.683	38.616	124.782	39.776	127.891	40.978	131.008	42.223	134.133	43.509	137.264	44.835	140.399	46.200	55	
50	98.370	30.958	101.408	31.918	104.463	32.930	107.535	33.993	110.621	35.106	113.720	36.267	116.831	37.476	119.950	38.731	123.077	40.031	126.210	41.375	129.347	42.761	132.486	44.188	135.625	45.655	50	40 (H)**
45	93.404	29.430	96.473	30.485	99.559	31.595	102.659	32.759	105.771	33.978	108.893	35.244	112.022	36.561	115.157	37.926	118.295	39.337	121.435	40.793	124.573	42.291	127.708	43.830	130.838	45.407	45	35 (P)*
40	88.497	28.085	91.598	29.252	94.712	30.478	97.836	31.762	100.968	33.100	104.105	34.491	107.244	35.933	110.383	37.423	113.518	38.960	116.648	40.540							40	30 (H)**
35	83.653	26.984	86.780	28.288	89.915	29.653	93.054	31.077	96.193	32.537	99.329	34.090															35	
33	81.732	26.633	84.867	27.998	88.006	29.426	91.144	30.912	94.279	32.455																	33	30 (P)*
30	78.863	26.225	82.003	27.691	85.139	29.220																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 95 Degrees

Δ=95°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	2735.773	1200.472	2738.276	1200.476	2740.781	1200.482	2743.285	1200.488	2745.792	1200.497	2748.298	1200.506	2750.806	1200.516	2753.315	1200.528	2755.824	1200.541	2758.334	1200.555	2760.846	1200.570	2763.358	1200.587	2765.871	1200.605	2500	
2200	2408.381	1056.416	2410.885	1056.421	2413.390	1056.427	2415.896	1056.436	2418.402	1056.445	2420.910	1056.455	2423.419	1056.467	2425.928	1056.480	2428.439	1056.495	2430.951	1056.511	2433.464	1056.529	2435.978	1056.548	2438.493	1056.568	2200	
2000	2190.120	960.380	2192.624	960.385	2195.129	960.392	2197.636	960.401	2200.143	960.411	2202.652	960.422	2205.161	960.436	2207.672	960.450	2210.184	960.466	2212.697	960.484	2215.211	960.503	2217.726	960.524	2220.243	960.546	2000	
1800	1971.859	864.343	1974.364	864.349	1976.869	864.357	1979.376	864.366	1981.885	864.377	1984.394	864.391	1986.905	864.405	1989.417	864.421	1991.930	864.439	1994.444	864.459	1996.960	864.480	1999.477	864.504	2001.995	864.528	1800	
1500	1644.469	720.289	1646.974	720.296	1649.480	720.305	1651.989	720.317	1654.499	720.330	1657.010	720.345	1659.522	720.363	1662.037	720.382	1664.553	720.404	1667.070	720.428	1669.589	720.454	1672.109	720.481	1674.631	720.511	1500	
1200	1317.078	576.235	1319.584	576.244	1322.093	576.256	1324.603	576.270	1327.115	576.287	1329.630	576.306	1332.146	576.328	1334.664	576.352	1337.183	576.379	1339.705	576.409	1342.229	576.441	1344.754	576.476	1347.281	576.513	1200	
1000	1098.818	480.200	1101.326	480.211	1103.836	480.225	1106.349	480.242	1108.863	480.262	1111.380	480.285	1113.899	480.312	1116.421	480.341	1118.944	480.373	1121.470	480.408	1123.999	480.447	1126.529	480.489	1129.062	480.533	1000	
900	989.688	432.183	992.197	432.193	994.708	432.211	997.222	432.229	999.739	432.252	1002.257	432.277	1004.779	432.307	1007.302	432.339	1009.829	432.373	1012.358	432.415	1014.889	432.457	1017.423	432.503	1019.959	432.553	900	
800	880.559	384.167	883.069	384.180	885.582	384.197	888.097	384.219	890.615	384.243	893.136	384.272	895.661	384.305	898.188	384.342	900.717	384.382	903.249	384.427	905.784	384.475	908.322	384.527	910.863	384.583	800	
700	771.430	336.150	773.941	336.166	776.456	336.186	778.973	336.210	781.493	336.239	784.019	336.271	786.546	336.309	789.077	336.351	791.610	336.397	794.147	336.448	796.687	336.503	799.231	336.562	801.777	336.626	700	100 (P)*
600	662.302	288.135	664.815	288.153	667.332	288.176	669.853	288.204	672.377	288.238	674.905	288.276	677.437	288.320	679.973	288.369	682.512	288.423	685.055	288.482	687.602	288.546	690.152	288.616	692.706	288.690	600	
500	553.174	240.121	555.690	240.143	558.210	240.170	560.735	240.204	563.264	240.244	565.798	240.291	568.336	240.343	570.879	240.401	573.426	240.466	575.978	240.537	578.533	240.614	581.094	240.698	583.658	240.787	500	
400	444.049	192.109	446.568	192.136	449.094	192.171	451.625	192.213	454.161	192.264	456.703	192.321	459.251	192.387	461.804	192.460	464.362	192.541	466.927	192.630	469.496	192.726	472.071	192.830	474.651	192.941	400	
360	400.399	172.906	402.921	172.936	405.449	172.974	407.984	173.021	410.524	173.077	413.071	173.141	415.624	173.214	418.183	173.295	420.748	173.385	423.318	173.484	425.895	173.591	428.479	173.706	431.067	173.831	360	
350	389.487	168.105	392.009	168.136	394.538	168.176	397.074	168.224	399.615	168.281	402.163	168.347	404.718	168.422	407.278	168.506	409.845	168.598	412.418	168.699	414.997	168.810	417.582	168.928	420.174	169.056	350	
300	334.926	144.102	337.433	144.138	339.986	144.185	342.528	144.241	345.076	144.308	347.632	144.385	350.195	144.472	352.765	144.570	355.343	144.677	357.928	144.796	360.520	144.924	363.119	145.063	365.725	145.212	300	80 (P)*
250	280.368	120.102	282.899	120.145	285.440	120.201	287.989	120.269	290.547	120.349	293.114	120.441	295.689	120.546	298.273	120.663	300.866	120.792	303.467	120.934	306.077	121.088	308.695	121.255	311.321	121.433	250	
230	258.345	110.503	261.079	110.550	263.623	110.610	266.177	110.684	268.740	110.771	271.312	110.872	273.894	110.986	276.485	111.113	279.085	111.254	281.695	111.408	284.314	111.575	286.942	111.756	289.579	111.950	230	
200	225.812	96.107	228.352	96.161	230.902	96.230	233.463	96.315	236.035	96.415	238.618	96.531	241.212	96.661	243.817	96.808	246.431	96.969	249.057	97.146	251.693	97.339	254.339	97.547	256.995	97.770	200	
170	193.082	81.713	195.628	81.777	198.187	81.858	200.759	81.958	203.344	82.076	205.941	82.212	208.550	82.366	211.172	82.538	213.807	82.728	216.453	82.936	219.111	83.163	221.782	83.407	224.464	83.669	170	65 (P)*
155	176.718	74.518	179.269	74.588	181.833	74.678	184.412	74.787	187.004	74.916	189.611	75.065	192.230	75.234	194.864	75.423	197.510	75.631	200.170	75.859	202.843	76.107	205.528	76.375	208.226	76.662	155	
125	143.994	60.134	146.557	60.221	149.137	60.332	151.733	60.467	154.347	60.627	156.978	60.812	159.625	61.021	162.288	61.255	164.968	61.513	167.663	61.796	170.374	62.103	173.100	62.434	175.841	62.790	125	
100	116.732	48.157	119.309	48.265	121.908	48.404	124.528	48.573	127.169	48.773	129.831	49.004	132.512	49.265	135.213	49.557	137.933	49.879	140.673	50.232	143.431	50.615	146.207	51.028	149.001	51.470	100	
90	105.830	43.371	108.416	43.491	111.025	43.645	113.658	43.833	116.314	44.055	118.992	44.311	121.692	44.601	124.413	44.925	127.156	45.283	129.919	45.674	132.702	46.099	135.504	46.557	138.326	47.048	90	50 (P)*
80	94.930	38.588	97.527	38.723	100.149	38.896	102.798	39.108	105.472	39.358	108.170	39.646	110.893	39.972	113.639	40.336	116.409	40.737	119.201	41.176	122.014	41.653	124.849	42.167	127.704	42.718	80	50 (H)**
70	84.035	33.811	86.644	33.965	89.284	34.163	91.952	34.405	94.649	34.690	97.374	35.019	100.125	35.391	102.902	35.806	105.705	36.264	108.532	36.764	111.383	37.307	114.257	37.892	117.152	38.519	70	
60	73.145	29.042	75.772	29.222	78.433	29.453	81.128	29.734	83.852	30.062	86.612	30.449	89.400	30.882	92.217	31.365	95.062	31.897	97.934	32.479	100.832	33.109	103.754	33.787	106.699	34.513	60	40 (P)*
55	67.703	26.662	70.341	26.858	73.016	27.110	75.727	27.417	78.472	27.779	81.251	28.196	84.061	28.667	86.902	29.193	89.773	29.772	92.672	30.404	95.597	31.089	98.548	31.826	101.522	32.614	55	
50	62.264	24.287	64.915	24.502	67.607	24.779	70.336	25.116	73.103	25.514	75.906	25.972	78.743	26.493	81.612	27.066	84.512	27.701	87.441	28.393	90.398	29.143	93.380	29.949	96.387	30.810	50	40 (H)**
45	56.829	21.916	59.496	22.156	62.207	22.463	64.959	22.837	67.752	23.278	70.583	23.786	73.451	24.359	76.352	24.997	79.286	25.699	82.250	26.465	85.242	27.292	88.261	28.181	91.302	29.129	45	35 (P)*
40	51.399	19.554	54.085	19.823	56.820	20.168	59.600	20.588	62.424	21.083	65.289	21.653	68.193	22.295	71.133	23.009	74.106	23.794	77.110	24.648	80.141	25.570	83.198	26.559	86.277	27.613	40	35 (H) 30 (P)*
35	45.976	17.502	48.687	17.509	51.451	17.903	54.266	18.382	57.128	18.946	60.035	19.593	62.982	20.323	65.966	21.132	68.984	22.021	72.032	22.986	75.107	24.026	78.204	25.139	81.321	26.322	35	
33	43.810	16.266	46.532	16.591	49.310	17.008	52.141	17.516	55.021	18.113	57.947	18.798	60.913	19.569	63.917	20.424	66.955	21.361	70.022	22.379	73.114	23.474	76.228	24.645	79.359	25.887	33	
30	40.564	14.867	43.306	15.225	46.109	15.683	48.967	16.239	51.877	16.894	54.834	17.643	57.832	18.486	60.868	19.420	63.937	20.441	67.032	21.548	70.150	22.736	73.286	24.003	76.434	25.345	30	30 (H)**
25	35.168	12.358	37.953	12.986	40.806	13.533	43.721	14.197	46.690	14.974	49.708	15.863	52.767	16.858	55.860	17.956	58.980	19.153	62.120	20.443	65.272	21.821	68.430	23.281	71.586	24.818	25	
23	33.017	11.645	35.823	12.110	38.701	12.703	41.642	13.421	44.640	14.262	47.686	15.221	50.770	16.292	53.886	17.472	57.025	18.754	60.177	20.132	63.335	21.599	66.490	23.149			23	25 (P)*
20	29.809	10.294	32.645	10.826	35.566	11.504	38.555	12.324	41.599	13.280	44.688	14.365	47.811	15.573	50.956	16.897	54.113	18.327	57.269	19.854							20	25 (H)**
15	24.484	8.120	27.417	8.822	30.434	9.710	33.516	10.774	36.643	12.002	39.795	13.379	42.952	14.891													15	20 (P)*
14	23.430	7.704	26.386	8.453	29.427	9.399	32.528	10.529	35.669	11.828	38.826	13.279															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 95 Degrees

$\Delta = 95°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2768.385	1200.624	2770.900	1200.666	2773.416	1200.666	2775.933	1200.689	2778.450	1200.713	2780.969	1200.738	2783.488	1200.765	2786.009	1200.792	2788.530	1200.821	2791.052	1200.853	2793.575	1200.883	2796.099	1200.916	2798.624	1200.950	2500	
2200	2441.009	1056.584	2443.526	1056.613	2446.043	1056.637	2448.562	1056.663	2451.083	1056.691	2453.604	1056.719	2456.126	1056.750	2458.649	1056.781	2461.173	1056.814	2463.698	1056.848	2466.224	1056.884	2468.751	1056.921	2471.279	1056.959	2200	
2000	2222.260	960.570	2225.279	960.596	2227.799	960.623	2230.319	960.651	2232.842	960.681	2235.365	960.713	2237.889	960.746	2240.414	960.781	2242.941	960.817	2245.469	960.855	2247.997	960.894	2250.527	960.935	2253.058	960.977	2000	
1800	2004.515	864.555	2007.036	864.583	2009.557	864.613	2012.081	864.645	2014.605	864.678	2017.131	864.713	2019.658	864.750	2022.186	864.789	2024.715	864.829	2027.246	864.871	2029.778	864.915	2032.311	864.960	2034.845	865.007	1800	
1500	1677.155	720.543	1679.679	720.577	1682.206	720.613	1684.734	720.651	1687.263	720.691	1689.793	720.733	1692.326	720.777	1694.860	720.823	1697.395	720.872	1699.931	720.922	1702.470	720.975	1705.009	721.029	1707.551	721.085	1500	
1200	1340.810	576.552	1342.341	576.595	1354.874	576.640	1357.408	576.687	1359.945	576.738	1362.483	576.790	1365.024	576.846	1367.566	576.904	1370.110	576.964	1372.656	577.027	1375.203	577.092	1377.753	577.160	1380.304	577.231	1200	
1000	1131.596	480.581	1134.134	480.632	1136.673	480.686	1139.214	480.743	1141.758	480.803	1144.304	480.866	1146.852	480.933	1149.403	481.002	1151.955	481.074	1154.510	481.150	1157.067	481.229	1159.626	481.310	1162.187	481.395	1000	
900	1022.498	432.606	1025.039	432.663	1027.583	432.723	1030.128	432.786	1032.677	432.853	1035.228	432.923	1037.781	432.997	1040.337	433.074	1042.896	433.154	1045.456	433.238	1048.019	433.326	1050.585	433.416	1053.153	433.511	900	
800	913.406	384.642	915.953	384.706	918.502	384.774	921.053	384.845	923.608	384.920	926.165	384.999	928.725	385.082	931.288	385.169	933.853	385.259	936.421	385.354	938.992	385.452	941.566	385.554	944.142	385.660	800	
700	804.327	336.694	806.879	336.767	809.436	336.844	811.994	336.926	814.556	337.011	817.122	337.102	819.690	337.196	822.261	337.296	824.836	337.399	827.413	337.507	829.994	337.619	832.578	337.736	835.165	337.857	700	
600	695.264	288.770	697.825	288.854	700.390	288.945	702.958	289.040	705.531	289.140	708.106	289.245	710.686	289.355	713.269	289.471	715.856	289.592	718.446	289.718	721.039	289.848	723.637	289.985	726.237	290.125	600	
500	586.227	240.883	588.800	240.984	591.378	241.092	593.960	241.206	596.546	241.326	599.137	241.453	601.731	241.585	604.331	241.724	606.934	241.869	609.542	242.019	612.153	242.177	614.769	242.340	617.389	242.509	500	
400	477.237	193.061	479.828	193.188	482.426	193.323	485.026	193.466	487.633	193.615	490.246	193.773	492.863	193.939	495.486	194.112	498.114	194.293	500.747	194.482	503.385	194.678	506.029	194.882	508.677	195.094	400	
360	433.663	173.963	436.263	174.104	438.870	174.254	441.482	174.412	444.101	174.579	446.725	174.755	449.355	174.938	451.991	175.131	454.632	175.332	457.279	175.541	459.932	175.759	462.591	175.985	465.255	176.220	360	
350	423.771	169.192	426.375	169.338	427.985	169.492	430.600	169.655	433.222	169.826	435.850	170.007	438.483	170.196	441.123	170.394	443.768	170.600	446.419	170.815	449.076	171.040	451.739	171.272	454.407	171.514	350	
300	368.338	145.371	370.958	145.540	373.585	145.720	376.219	145.910	378.860	146.110	381.508	146.320	384.163	146.540	386.824	146.771	389.492	147.012	392.167	147.263	394.848	147.524	397.536	147.796	400.230	148.078	300	
250	313.956	121.624	316.599	121.827	319.250	122.042	321.909	122.270	324.576	122.510	327.252	122.762	329.935	123.027	332.626	123.303	335.326	123.592	338.033	123.893	340.747	124.206	343.469	124.531	346.199	124.868	250	
230	292.224	112.157	294.879	112.378	297.542	112.612	300.215	112.859	302.896	113.120	305.585	113.394	308.283	113.681	310.990	113.981	313.705	114.295	316.428	114.622	319.160	114.962	321.899	115.315	324.647	115.681	230	
200	259.661	98.008	262.338	98.262	265.024	98.531	267.720	98.815	270.426	99.114	273.142	99.429	275.867	99.759	278.601	100.104	281.345	100.464	284.099	100.839	286.861	101.229	289.633	101.635	292.413	102.055	200	
170	221.157	83.949	229.862	84.247	232.579	84.563	235.306	84.897	238.045	85.248	240.795	85.618	243.555	86.005	246.327	86.410	249.109	86.833	251.901	87.273	254.704	87.731	257.517	88.207	260.339	88.699	170	
155	210.937	76.969	213.660	77.296	216.396	77.642	219.143	78.008	221.903	78.393	224.674	78.798	227.456	79.222	230.251	79.665	233.056	80.128	235.873	80.610	238.700	81.111	241.539	81.632	244.388	82.171	155	65 (P)*
125	178.597	63.170	181.368	63.573	184.133	64.001	186.952	64.453	189.765	64.929	192.592	65.429	195.432	65.952	198.285	66.499	201.151	67.070	204.030	67.664	206.921	68.282	209.824	68.922	212.739	69.586	125	
100	151.812	51.943	154.640	52.446	157.485	52.978	160.347	53.540	163.224	54.131	166.116	54.752	169.024	55.401	171.946	56.079	174.882	56.786	177.832	57.522	180.796	58.286	183.772	59.078	186.761	59.897	100	
90	141.167	47.572	144.025	48.129	146.901	48.718	149.795	49.340	152.705	49.994	155.631	50.681	158.573	51.399	161.529	52.149	164.501	52.930	167.486	53.742	170.485	54.584	173.497	55.458	176.521	56.362	90	50 (P)
80	130.579	43.305	133.473	43.929	136.386	44.589	139.317	45.286	142.266	46.018	145.231	46.785	148.212	47.587	151.208	48.424	154.219	49.296	157.244	50.202	160.283	51.141	163.334	52.113	166.396	53.119	80	50 (H)**
70	120.069	39.187	123.007	39.896	125.963	40.645	128.939	41.435	131.932	42.265	134.942	43.134	137.968	44.042	141.009	44.988	144.064	45.973	147.133	46.994	150.214	48.053	153.306	49.148	156.409	50.278	70	40 (P)*
60	109.667	35.286	112.656	36.106	115.663	36.972	118.692	37.883	121.736	38.839	124.797	39.839	127.873	40.882	130.963	41.968	134.065	43.095	137.178	44.264	140.301	45.473	143.433	46.720	146.572	48.007	60	
55	104.519	33.453	107.537	34.341	110.575	35.279	113.631	36.265	116.703	37.299	119.791	38.379	122.893	39.504	126.006	40.675	129.131	41.888	132.264	43.145	135.406	44.443	138.554	45.782	141.706	47.160	55	
50	99.416	31.726	102.466	32.695	105.534	33.716	108.620	34.790	111.720	35.913	114.835	37.085	117.961	38.306	121.096	39.573	124.240	40.885	127.390	42.242	130.545	43.641	133.702	45.082	136.861	46.562	50	40 (H)**
45	94.366	30.136	97.448	31.201	100.548	32.322	103.665	33.497	106.791	34.725	109.929	36.005	113.076	37.333	116.228	38.713	119.385	40.137	122.543	41.607	125.700	43.119	128.856	44.672	132.006	46.265	45	35 (P)*
40	89.326	28.730	92.492	29.909	95.622	31.147	98.763	32.443	101.912	33.794	105.067	35.198	108.225	36.654	111.383	38.158	114.538	39.709	117.688	41.304							40	30 (H)**
35	84.454	27.572	87.598	28.888	90.750	30.266	93.907	31.704	97.065	33.198	100.221	34.745															35	
33	82.502	27.199	85.655	28.577	88.812	30.018	91.970	31.518	95.123	33.075																	33	30 (P)*
30	79.590	26.758	82.748	28.238	85.904	29.782																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 96 Degrees

$\Delta = 96°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S		
metre																											metre	
2500	2784.034	1236.194	2786.537	1236.198	2789.042	1236.204	2791.546	1236.211	2794.052	1236.219	2796.559	1236.228	2799.067	1236.239	2801.576	1236.251	2804.086	1236.264	2806.596	1236.278	2809.108	1236.293	2811.620	1236.311	2814.134	1236.329	2500	
2200	2450.851	1087.852	2453.355	1087.857	2455.859	1087.863	2458.365	1087.871	2460.872	1087.880	2463.380	1087.891	2465.889	1087.903	2468.399	1087.917	2470.910	1087.932	2473.422	1087.948	2475.935	1087.966	2478.449	1087.984	2480.964	1088.003	2200	
2000	2228.729	988.958	2231.233	988.963	2233.738	988.970	2236.245	988.979	2238.752	988.989	2241.261	989.001	2243.771	989.014	2246.281	989.029	2248.793	989.045	2251.307	989.063	2253.822	989.083	2256.337	989.103	2258.854	989.126	2000	
1800	2006.607	890.063	2009.112	890.070	2011.617	890.077	2014.125	890.087	2016.633	890.098	2019.143	890.111	2021.654	890.126	2024.166	890.142	2026.679	890.160	2029.194	890.180	2031.710	890.202	2034.227	890.225	2036.745	890.250	1800	
1500	1673.425	741.722	1675.930	741.730	1678.437	741.739	1680.946	741.750	1683.456	741.764	1685.967	741.780	1688.480	741.797	1690.995	741.817	1693.511	741.839	1696.029	741.863	1698.548	741.888	1701.068	741.917	1703.591	741.947	1500	
1200	1340.243	593.382	1342.750	593.391	1345.259	593.403	1347.769	593.417	1350.281	593.434	1352.796	593.454	1355.312	593.476	1357.831	593.500	1360.350	593.527	1362.872	593.557	1365.396	593.590	1367.922	593.625	1370.450	593.662	1200	
1000	1118.122	494.489	1120.630	494.500	1123.141	494.514	1125.654	494.531	1128.168	494.552	1130.686	494.575	1133.205	494.602	1135.727	494.631	1138.251	494.664	1140.777	494.699	1143.306	494.739	1145.837	494.780	1148.371	494.826	1000	
900	1007.062	445.043	1009.571	445.056	1012.083	445.071	1014.597	445.090	1017.113	445.113	1019.633	445.138	1022.154	445.168	1024.678	445.201	1027.206	445.237	1029.735	445.277	1032.266	445.320	1034.801	445.367	1037.338	445.417	900	
800	896.002	395.598	898.513	395.611	901.026	395.629	903.541	395.650	906.060	395.676	908.582	395.705	911.106	395.738	913.633	395.775	916.163	395.816	918.696	395.861	921.232	395.909	923.771	395.962	926.312	396.018	800	
700	784.943	346.153	787.455	346.168	789.969	346.188	792.488	346.213	795.009	346.242	797.534	346.275	800.062	346.313	802.593	346.355	805.127	346.402	807.665	346.453	810.205	346.509	812.750	346.569	815.296	346.633	700	100 (P)*
600	673.885	296.708	676.398	296.727	678.915	296.750	681.436	296.779	683.961	296.812	686.490	296.851	689.022	296.895	691.558	296.945	694.098	296.999	696.642	297.059	699.190	297.124	701.741	297.194	704.296	297.269	600	
500	562.827	247.266	565.343	247.288	567.864	247.315	570.389	247.350	572.918	247.390	575.453	247.437	577.992	247.490	580.535	247.549	583.083	247.614	585.635	247.686	588.192	247.764	590.754	247.848	593.320	247.938	500	
450	451.771	197.825	454.291	197.853	456.817	197.887	459.348	197.930	461.885	197.981	464.428	198.039	466.977	198.105	469.531	198.179	472.090	198.261	474.656	198.351	477.226	198.448	479.802	198.553	482.384	198.666	450	
400	407.349	178.050	409.872	178.081	412.400	178.119	414.935	178.167	417.476	178.223	420.024	178.288	422.578	178.361	425.138	178.444	427.704	178.534	430.276	178.634	432.854	178.742	435.439	178.858	438.030	178.984	400	
350	396.244	173.106	398.767	173.137	401.296	173.178	403.832	173.227	406.375	173.284	408.924	173.351	411.479	173.427	414.041	173.511	416.608	173.604	419.183	173.707	421.763	173.818	424.350	173.938	426.943	174.067	350	
300	340.718	148.389	343.245	148.426	345.779	148.472	348.321	148.529	350.871	148.597	353.427	148.675	355.992	148.763	358.563	148.861	361.142	148.970	363.729	149.090	366.323	149.219	368.923	149.359	371.531	149.510	300	80 (P)*
250	285.194	123.675	287.727	123.719	290.268	123.774	292.818	123.843	295.377	123.924	297.945	124.017	300.521	124.123	303.107	124.241	305.702	124.372	308.305	124.515	310.916	124.671	313.536	124.838	316.165	125.019	250	
230	262.986	113.790	265.521	113.838	268.065	113.898	270.620	113.973	273.184	114.061	275.758	114.162	278.341	114.277	280.934	114.406	283.536	114.548	286.147	114.703	288.769	114.872	291.399	115.055	294.038	115.251	230	
200	229.674	98.965	232.214	99.020	234.765	99.090	237.328	99.175	239.901	99.276	242.486	99.393	245.081	99.525	247.687	99.673	250.305	99.836	252.932	100.015	255.570	100.209	258.219	100.419	260.878	100.644	200	
170	196.365	84.143	198.912	84.207	201.472	84.290	204.045	84.390	206.631	84.509	209.230	84.647	211.842	84.802	214.466	84.976	217.103	85.168	219.752	85.378	222.413	85.606	225.086	85.853	227.772	86.118	170	65 (P)*
155	179.711	76.734	182.263	76.804	184.829	76.895	187.409	77.005	190.003	77.136	192.611	77.286	195.233	77.457	197.869	77.647	200.518	77.858	203.181	78.088	205.857	78.338	208.546	78.609	211.248	78.899	155	
125	146.409	61.922	148.972	62.009	151.554	62.121	154.152	62.258	156.768	62.419	159.401	62.606	162.051	62.817	164.717	63.053	167.400	63.314	170.099	63.599	172.814	63.909	175.544	64.244	178.290	64.603	125	
100	118.664	49.388	121.243	49.697	123.844	49.837	126.466	50.008	129.110	50.210	131.774	50.442	134.459	50.706	137.164	51.001	139.888	51.326	142.632	51.682	145.395	52.069	148.176	52.485	150.976	52.933	100	
90	107.569	44.658	110.157	44.779	112.768	44.935	115.404	45.125	118.062	45.349	120.743	45.608	123.447	45.901	126.173	46.238	128.920	46.589	131.688	46.984	134.477	47.412	137.285	47.875	140.113	48.371	90	50 (P)*
80	96.477	39.733	99.075	39.869	101.700	40.044	104.351	40.258	107.028	40.510	109.731	40.801	112.458	41.130	115.209	41.497	117.983	41.903	120.781	42.346	123.601	42.827	126.442	43.346	129.304	43.902	80	50 (H)**
70	85.389	34.813	88.000	34.969	90.642	35.169	93.314	35.413	96.014	35.701	98.743	36.032	101.499	36.408	104.282	36.827	107.091	37.289	109.924	37.795	112.782	38.343	115.664	38.933	118.568	39.566	70	
60	74.306	29.902	76.926	30.083	79.600	30.316	82.298	30.600	85.029	30.936	87.792	31.322	90.586	31.760	93.409	32.247	96.261	32.785	99.140	33.372	102.046	34.008	104.977	34.693	107.932	35.426	60	40 (P)*
55	68.768	27.451	71.409	27.648	74.087	27.902	76.802	28.212	79.552	28.578	82.336	28.999	85.152	29.475	88.000	30.006	90.879	30.591	93.786	31.229	96.720	31.920	99.680	32.664	102.665	33.460	55	
50	63.233	25.004	65.887	25.221	68.582	25.500	71.316	25.841	74.088	26.243	76.897	26.705	79.740	27.228	82.617	27.810	85.525	28.451	88.464	29.150	91.430	29.907	94.423	30.721	97.441	31.590	50	40 (H)**
45	57.702	22.562	60.372	22.804	63.086	23.114	65.844	23.492	68.643	23.937	71.480	24.450	74.355	25.029	77.265	25.673	80.208	26.382	83.182	27.155	86.185	27.990	89.215	28.887	92.269	29.845	45	35 (P)*
40	52.176	20.129	54.865	20.400	57.604	20.749	60.390	21.173	63.221	21.673	66.094	22.248	69.006	22.896	71.955	23.617	74.938	24.409	77.953	25.272	80.996	26.203	84.066	27.202	87.159	28.266	40	35 (H) 30 (P)*
35	46.657	17.706	49.372	18.016	52.141	18.414	54.962	18.897	57.832	19.467	60.747	20.120	63.703	20.857	66.698	21.674	69.728	22.571	72.788	23.546	75.877	24.596	78.989	25.720	82.121	26.914	35	
33	44.452	16.741	47.179	17.070	49.963	17.491	52.800	18.003	55.688	18.606	58.622	19.298	61.599	20.076	64.614	20.940	67.664	21.886	70.744	22.914	73.851	24.020	76.980	25.201	80.127	26.456	33	
30	41.149	15.300	43.896	15.661	46.704	16.124	49.570	16.686	52.489	17.346	55.455	18.103	58.465	18.954	61.513	19.897	64.594	20.928	67.705	22.045	70.838	23.245	73.990	24.525	77.156	25.879	30	30 (H)**
25	35.658	12.921	38.448	13.353	41.308	13.905	44.232	14.575	47.212	15.360	50.241	16.257	53.313	17.262	56.420	18.371	59.556	19.579	62.713	20.881	65.893	22.275	69.096	23.747	72.326	25.299	25	
23	33.469	11.980	36.281	12.449	39.166	13.047	42.117	13.773	45.126	14.622	48.184	15.590	51.283	16.672	54.414	17.863	57.569	19.157	60.739	20.548	63.916	22.030	67.092	23.594			23	25 (P)*
20	30.195	10.587	33.047	11.124	35.977	11.809	38.976	12.636	42.033	13.601	45.136	14.697	48.275	15.917	51.437	17.253	54.612	18.697	57.789	20.239							20	25 (H)**
15	24.785	8.343	27.727	9.052	30.756	9.948	33.852	11.023	36.995	12.262	40.165	13.653	43.342	15.179													15	20 (P)*
14	23.714	7.913	26.679	8.670	29.732	9.625	32.848	10.766	36.006	12.077	39.182	13.542															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 96 Degrees

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Δ=96°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2816.648	1236.348	2819.163	1236.368	2821.679	1236.390	2824.196	1236.413	2826.714	1236.438	2829.233	1236.463	2831.753	1236.490	2834.274	1236.518	2836.795	1236.547	2839.318	1236.578	2841.841	1236.609	2844.365	1236.642	2846.891	1236.677	2500	
2200	2483.480	1088.027	2485.998	1088.050	2488.516	1088.075	2491.035	1088.101	2493.556	1088.129	2496.077	1088.158	2498.600	1088.188	2501.123	1088.220	2503.648	1088.253	2506.173	1088.288	2508.700	1088.324	2511.227	1088.362	2513.756	1088.400	2200	
2000	2261.371	989.150	2263.890	989.176	2266.410	989.203	2268.932	989.232	2271.454	989.262	2273.978	989.294	2276.502	989.328	2279.028	989.362	2281.555	989.399	2284.083	989.437	2286.613	989.477	2289.143	989.518	2291.674	989.561	2000	
1800	2039.265	890.277	2041.786	890.306	2044.309	890.336	2046.833	890.368	2049.357	890.402	2051.883	890.437	2054.411	890.474	2056.939	890.513	2059.469	890.554	2062.000	890.596	2064.533	890.640	2067.067	890.686	2069.602	890.734	1800	
1500	1706.114	741.979	1708.640	742.013	1711.167	742.050	1713.695	742.088	1716.224	742.128	1718.756	742.171	1721.289	742.216	1723.823	742.262	1726.359	742.311	1728.896	742.362	1731.435	742.415	1733.975	742.469	1736.517	742.527	1500	
1200	1372.979	593.702	1375.511	593.746	1378.044	593.791	1380.580	593.839	1383.117	593.889	1385.656	593.943	1388.197	593.998	1390.740	594.057	1393.285	594.118	1395.831	594.181	1398.379	594.247	1400.930	594.316	1403.482	594.387	1200	
1000	1150.906	494.874	1153.444	494.925	1155.984	494.979	1158.526	495.037	1161.071	495.098	1163.617	495.162	1166.166	495.229	1168.718	495.299	1171.271	495.372	1173.827	495.448	1176.385	495.528	1178.945	495.610	1181.507	495.696	1000	
900	1039.877	445.471	1042.419	445.529	1044.964	445.588	1047.510	445.652	1050.060	445.720	1052.612	445.790	1055.166	445.865	1057.723	445.943	1060.282	446.024	1062.844	446.109	1065.408	446.197	1067.975	446.288	1070.544	446.384	900	
800	928.856	396.078	931.404	396.143	933.953	396.211	936.506	396.283	939.061	396.359	941.620	396.438	944.181	396.522	946.744	396.610	949.311	396.701	951.881	396.796	954.452	396.895	957.027	396.999	959.605	397.105	800	
700	817.847	346.702	820.401	346.775	822.958	346.853	825.518	346.936	828.081	347.022	830.647	347.113	833.217	347.209	835.790	347.309	838.365	347.413	840.944	347.522	843.527	347.636	846.112	347.753	848.700	347.876	700	
600	706.855	297.349	709.417	297.435	711.983	297.526	714.553	297.622	717.127	297.723	719.704	297.829	722.285	297.941	724.869	298.057	727.458	298.179	730.049	298.306	732.645	298.438	735.244	298.576	737.846	298.718	600	
500	595.890	248.034	598.464	248.137	601.043	248.246	603.627	248.362	606.215	248.483	608.807	248.610	611.403	248.744	614.004	248.884	616.609	249.030	619.219	249.182	621.833	249.341	624.451	249.506	627.073	249.677	500	
400	484.972	198.786	487.564	198.914	490.162	199.050	492.766	199.195	495.375	199.346	497.990	199.505	500.609	199.672	503.234	199.848	505.865	200.030	508.500	200.220	511.141	200.419	513.787	200.625	516.439	200.838	400	
360	440.626	179.118	443.229	179.260	445.837	179.411	448.452	179.571	451.073	179.740	453.699	179.917	456.332	180.103	458.970	180.297	461.614	180.500	464.264	180.711	466.920	180.931	469.581	181.159	472.248	181.397	360	100 (P)*
350	429.542	174.204	432.148	174.351	434.760	174.507	437.378	174.671	440.001	174.844	442.631	175.026	445.267	175.217	447.909	175.417	450.557	175.625	453.211	175.843	455.871	176.070	458.537	176.304	461.209	176.549	350	
300	374.146	149.670	376.769	149.841	379.398	150.022	382.035	150.214	384.678	150.416	387.329	150.628	389.986	150.851	392.651	151.084	395.322	151.327	398.000	151.581	400.685	151.844	403.376	152.119	406.074	152.403	300	
250	318.802	125.211	321.448	125.417	324.102	125.634	326.764	125.864	329.435	126.106	332.113	126.361	334.800	126.627	337.495	126.907	340.198	127.198	342.909	127.502	345.627	127.818	348.354	128.146	351.088	128.487	250	
230	296.687	115.460	299.344	115.683	302.011	115.919	304.687	116.169	307.371	116.432	310.064	116.209	312.766	116.999	315.476	117.302	318.195	117.618	320.923	117.948	323.659	118.292	326.403	118.648	329.156	119.018	230	80 (P)*
200	263.548	100.885	266.228	101.141	268.917	101.412	271.617	101.699	274.327	102.002	277.047	102.319	279.776	102.652	282.515	103.000	285.264	103.364	288.022	103.743	290.790	104.137	293.567	104.546	296.353	104.971	200	
170	230.469	86.400	233.178	86.701	235.898	87.020	238.631	87.357	241.374	87.712	244.128	88.085	246.894	88.476	249.671	88.885	252.458	89.312	255.256	89.757	258.065	90.219	260.884	90.699	263.713	91.197	170	
155	213.962	79.209	216.690	79.538	219.430	79.888	222.182	80.257	224.946	80.646	227.723	81.055	230.511	81.483	233.311	81.931	236.123	82.398	238.946	82.885	241.780	83.391	244.625	83.916	247.481	84.461	155	65 (P)*
125	181.051	64.986	183.827	65.394	186.618	65.826	189.423	66.282	192.242	66.763	195.075	67.267	197.922	67.796	200.782	68.348	203.656	68.924	206.542	69.524	209.441	70.147	212.353	70.794	215.276	71.465	125	
100	153.794	53.410	156.629	53.918	159.480	54.455	162.349	55.022	165.234	55.619	168.134	56.246	171.050	56.901	173.981	57.586	176.927	58.300	179.887	59.043	182.860	59.814	185.847	60.613	188.846	61.441	100	
90	142.961	48.900	145.827	49.462	148.710	50.057	151.612	50.685	154.530	51.346	157.466	52.039	160.417	52.764	163.383	53.521	166.365	54.309	169.361	55.129	172.371	55.980	175.394	56.862	178.430	57.775	90	50 (P)
80	132.187	44.495	135.090	45.125	138.011	45.792	140.951	46.495	143.909	47.234	146.884	48.009	149.876	48.819	152.883	49.664	155.906	50.544	158.942	51.458	161.993	52.407	165.057	53.389	168.132	54.404	80	50 (H)**
70	121.493	40.241	124.440	40.956	127.406	41.713	130.392	42.511	133.396	43.349	136.417	44.226	139.455	45.143	142.509	46.098	145.577	47.092	148.658	48.124	151.753	49.192	154.860	50.298	157.977	51.439	70	
60	110.910	36.206	113.909	37.034	116.929	37.908	119.968	38.828	123.025	39.793	126.099	40.803	129.189	41.856	132.292	42.952	135.409	44.091	138.538	45.270	141.677	46.491	144.825	47.751	147.981	49.049	60	40 (P)*
55	105.673	34.307	108.703	35.204	111.752	36.151	114.821	37.146	117.907	38.190	121.009	39.280	124.125	40.416	127.254	41.598	130.394	42.824	133.544	44.093	136.703	45.403	139.868	46.755	143.039	48.146	55	
50	100.482	32.515	103.544	33.493	106.626	34.525	109.726	35.608	112.841	36.742	115.970	37.926	119.112	39.158	122.265	40.438	125.426	41.763	128.593	43.132	131.766	44.545	134.942	46.000	138.120	47.494	50	40 (H)**
45	95.346	30.862	98.442	31.937	101.557	33.068	104.687	34.255	107.831	35.495	110.986	36.787	114.149	38.130	117.320	39.521	120.495	40.959	123.672	42.443	126.850	43.970	130.025	45.538	133.196	47.146	45	35 (P)*
40	90.273	29.394	93.404	30.584	96.550	31.834	99.708	33.142	102.875	34.506	106.048	35.924	109.225	37.393	112.402	38.912	115.578	40.478	118.749	42.089							40	30 (H)**
35	85.270	28.176	88.431	29.505	91.601	30.896	94.777	32.347	97.955	33.856	101.131	35.418															35	
33	83.287	27.780	86.458	29.171	89.634	30.626	92.811	32.141	95.986	33.713																	33	30 (P)*
30	80.330	27.306	83.507	28.801	86.683	30.359																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 97 Degrees

$\Delta = 97°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	2833.236	1272.906	2835.740	1272.910	2838.244	1272.916	2840.749	1272.923	2843.255	1272.931	2845.762	1272.940	2848.270	1272.951	2850.779	1272.963	2853.289	1272.976	2855.800	1272.991	2858.312	1273.006	2860.824	1273.023	2863.338	1273.042	2500	
2200	2494.149	1120.158	2496.653	1120.164	2499.158	1120.170	2501.664	1120.178	2504.171	1120.187	2506.678	1120.198	2509.188	1120.210	2511.698	1120.224	2514.209	1120.239	2516.721	1120.255	2519.235	1120.273	2521.749	1120.292	2524.264	1120.313	2200	
2000	2268.091	1018.327	2270.595	1018.333	2273.100	1018.340	2275.607	1018.348	2278.115	1018.359	2280.624	1018.371	2283.134	1018.384	2285.645	1018.399	2288.157	1018.415	2290.670	1018.433	2293.185	1018.453	2295.701	1018.474	2298.218	1018.497	2000	
1800	2042.033	916.496	2044.538	916.502	2047.043	916.510	2049.551	916.519	2052.059	916.531	2054.569	916.544	2057.080	916.559	2059.592	916.575	2062.106	916.594	2064.621	916.614	2067.138	916.636	2069.655	916.659	2072.174	916.685	1800	
1500	1702.947	763.750	1705.452	763.757	1707.959	763.766	1710.468	763.778	1712.978	763.791	1715.490	763.807	1718.002	763.825	1720.518	763.845	1723.034	763.867	1725.552	763.891	1728.072	763.917	1730.593	763.946	1733.115	763.976	1500	
1200	1363.860	611.004	1366.367	611.013	1368.876	611.025	1371.387	611.039	1373.899	611.056	1376.414	611.076	1378.931	611.098	1381.449	611.123	1383.970	611.150	1386.492	611.181	1389.017	611.213	1391.543	611.249	1394.071	611.287	1200	
1000	1137.803	509.174	1140.312	509.185	1142.823	509.199	1145.335	509.217	1147.850	509.237	1150.368	509.261	1152.888	509.288	1155.410	509.317	1157.935	509.350	1160.461	509.386	1162.991	509.426	1165.522	509.468	1168.056	509.514	1000	
900	1024.775	458.266	1027.285	458.272	1029.796	458.288	1032.311	458.307	1034.827	458.330	1037.347	458.356	1039.869	458.385	1042.394	458.419	1044.921	458.456	1047.451	458.496	1049.983	458.539	1052.518	458.586	1055.056	458.637	900	
800	911.748	407.346	914.258	407.359	916.771	407.377	919.287	407.399	921.806	407.424	924.328	407.454	926.853	407.487	929.381	407.524	931.911	407.566	934.445	407.611	936.981	407.660	939.521	407.713	942.063	407.770	800	
700	798.720	356.432	801.232	356.448	803.747	356.468	806.265	356.493	808.787	356.522	811.312	356.556	813.841	356.594	816.372	356.636	818.907	356.684	821.446	356.736	823.987	356.792	826.532	356.852	829.080	356.917	700	100 (P)*
600	685.693	305.520	688.207	305.538	690.725	305.562	693.246	305.590	695.771	305.624	698.301	305.664	700.834	305.708	703.370	305.758	705.911	305.813	708.456	305.873	711.004	305.939	713.556	306.010	716.112	306.085	600	
500	572.668	254.608	575.184	254.631	577.703	254.658	580.231	254.693	582.761	254.734	585.296	254.781	587.836	254.835	590.380	254.894	592.928	254.960	595.482	255.033	598.040	255.111	600.602	255.196	603.169	255.287	500	
400	459.644	203.699	462.164	203.727	464.690	203.762	467.222	203.805	469.760	203.857	472.304	203.916	474.853	203.982	477.408	204.057	479.969	204.139	482.535	204.230	485.107	204.328	487.685	204.434	490.268	204.548	400	
360	414.435	183.337	416.958	183.368	419.487	183.407	422.022	183.455	424.564	183.512	427.113	183.577	429.667	183.651	432.229	183.734	434.796	183.826	437.369	183.926	439.949	184.035	442.535	184.153	445.127	184.280	360	
350	403.133	178.247	405.656	178.278	408.186	178.318	410.723	178.368	413.266	178.426	415.816	178.493	418.372	178.570	420.935	178.655	423.504	178.750	426.080	178.853	428.662	178.965	431.250	179.086	433.845	179.216	350	
300	346.623	152.795	349.150	152.832	351.685	152.879	354.228	152.937	356.778	153.005	359.336	153.083	361.902	153.172	364.474	153.272	367.055	153.382	369.643	153.502	372.238	153.633	374.841	153.774	377.451	153.926	300	80 (P)*
250	290.115	127.347	292.648	127.391	295.190	127.447	297.741	127.516	300.301	127.598	302.870	127.692	305.448	127.799	308.036	127.919	310.632	128.051	313.237	128.195	315.850	128.352	318.473	128.522	321.104	128.704	250	
230	267.513	117.168	270.049	117.216	272.594	117.278	275.149	117.353	277.715	117.442	280.290	117.544	282.875	117.660	285.469	117.790	288.073	117.933	290.687	118.090	293.310	118.261	295.943	118.445	298.585	118.643	230	
200	233.611	101.903	236.152	101.958	238.704	102.029	241.268	102.115	243.842	102.217	246.429	102.335	249.026	102.469	251.634	102.618	254.253	102.782	256.883	102.963	259.523	103.159	262.176	103.371	264.838	103.598	200	
170	199.712	86.640	202.259	86.703	204.821	86.788	207.395	86.890	209.983	87.010	212.584	87.149	215.197	87.306	217.824	87.481	220.463	87.675	223.115	87.887	225.779	88.118	228.456	88.367	231.145	88.634	170	65 (P)*
155	182.763	79.011	185.316	79.082	187.883	79.173	190.464	79.285	193.060	79.417	195.670	79.569	198.294	79.741	200.933	79.933	203.585	80.146	206.250	80.378	208.930	80.631	211.622	80.904	214.328	81.197	155	
125	148.870	63.758	151.435	63.846	154.018	63.959	156.618	64.098	159.236	64.261	161.872	64.449	164.524	64.663	167.194	64.901	169.880	65.164	172.583	65.452	175.302	65.765	178.036	66.103	180.787	66.466	125	
100	120.634	51.057	123.214	51.167	125.817	51.309	128.442	51.481	131.088	51.685	133.755	51.921	136.443	52.187	139.152	52.485	141.881	52.813	144.630	53.172	147.397	53.563	150.184	53.984	152.990	54.435	100	
90	109.342	45.982	111.931	46.104	114.545	46.261	117.183	46.453	119.844	46.679	122.529	46.940	125.237	47.236	127.967	47.566	130.719	47.931	133.492	48.330	136.286	48.763	139.101	49.230	141.936	49.730	90	50 (P)*
80	98.054	40.910	100.654	41.047	103.281	41.224	105.935	41.439	108.615	41.694	111.322	41.988	114.053	42.320	116.809	42.691	119.589	43.101	122.392	43.548	125.218	44.034	128.066	44.558	130.936	45.120	80	50 (H)**
70	86.769	35.843	89.383	36.000	92.027	36.202	94.702	36.448	97.406	36.739	100.140	37.074	102.901	37.454	105.689	37.877	108.504	38.344	111.344	38.854	114.209	39.407	117.098	40.004	120.011	40.645	70	
60	75.490	30.785	78.122	30.968	80.789	31.204	83.491	31.491	86.227	31.830	88.995	32.220	91.794	32.661	94.624	33.153	97.483	33.696	100.370	34.289	103.284	34.931	106.224	35.623	109.189	36.363	60	40 (P)*
55	69.854	28.261	72.497	28.461	75.179	28.717	77.898	29.030	80.652	29.399	83.442	29.824	86.265	30.305	89.120	30.841	92.006	31.432	94.921	32.076	97.865	32.774	100.835	33.526	103.830	34.329	55	
50	64.221	25.741	66.878	25.960	69.576	26.242	72.315	26.586	75.092	26.992	77.907	27.459	80.757	27.986	83.642	28.574	86.558	29.222	89.506	29.928	92.482	30.692	95.486	31.514	98.515	32.392	50	40 (H)**
45	58.591	23.226	61.265	23.470	63.983	23.783	66.746	24.165	69.550	24.615	72.395	25.132	75.277	25.717	78.196	26.367	81.148	27.083	84.133	27.864	87.146	28.707	90.188	29.613	93.255	30.580	45	35 (P)*
40	52.968	20.720	55.661	20.994	58.404	21.346	61.196	21.774	64.033	22.279	66.913	22.859	69.834	23.514	72.792	24.242	75.786	25.042	78.812	25.913	81.868	26.854	84.951	27.862	88.058	28.937	40	35 (H) 30 (P)*
35	47.331	18.224	50.070	18.537	52.844	18.938	55.672	19.427	58.549	20.002	61.473	20.662	64.439	21.406	67.444	22.231	70.486	23.137	73.559	24.121	76.661	25.182	79.788	26.316	82.936	27.522	35	
33	45.107	17.230	47.838	17.562	50.628	17.987	53.472	18.505	56.368	19.113	59.311	19.811	62.298	20.597	65.325	21.470	68.387	22.426	71.481	23.463	74.602	24.580	77.746	25.773	80.910	27.040	33	
30	41.746	15.745	44.497	16.110	47.312	16.577	50.185	17.144	53.112	17.811	56.088	18.576	59.109	19.435	62.170	20.387	65.265	21.428	68.390	22.557	71.539	23.769	74.708	25.060	77.892	26.429	30	30 (H)**
25	36.157	13.293	38.953	13.729	41.821	14.287	44.753	14.964	47.743	15.757	50.784	16.663	53.870	17.678	56.992	18.797	60.143	20.017	63.317	21.332	66.506	22.737	69.702	24.226	72.899	25.793	25	
23	33.929	12.324	36.748	12.797	39.641	13.402	42.602	14.134	45.622	14.991	48.692	15.969	51.805	17.062	54.952	18.264	58.124	19.571	61.313	20.976	64.509	22.472	67.705	24.052			23	25 (P)*
20	30.598	10.887	33.457	11.430	36.306	12.121	39.406	12.937	42.476	13.931	45.593	15.038	48.748	16.270	51.928	17.619	55.122	19.077	58.319	20.634							20	25 (H)**
15	25.092	8.572	28.044	9.288	31.085	10.193	34.195	11.278	37.354	12.530	40.542	13.935	43.739	15.476													15	20 (P)*
14	24.002	8.129	26.978	8.892	30.043	9.857	33.175	11.009	36.350	12.333	39.545	13.813															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 97 Degrees

△=97°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2865.853	1273.061	2868.368	1273.082	2870.884	1273.104	2873.402	1273.127	2875.920	1273.152	2878.439	1273.177	2880.959	1273.204	2883.480	1273.233	2886.002	1273.262	2888.525	1273.293	2891.049	1273.325	2893.574	1273.358	2896.100	1273.393	2500	
2200	2526.781	1120.335	2529.298	1120.358	2531.817	1120.384	2534.337	1120.410	2536.858	1120.438	2539.379	1120.467	2541.902	1120.498	2544.426	1120.530	2546.951	1120.564	2549.477	1120.599	2552.004	1120.635	2554.532	1120.673	2557.061	1120.712	2200	
2000	2300.736	1018.521	2303.255	1018.547	2305.776	1018.575	2308.297	1018.604	2310.820	1018.634	2313.344	1018.667	2315.869	1018.701	2318.396	1018.736	2320.923	1018.773	2323.452	1018.811	2325.981	1018.851	2328.512	1018.893	2331.044	1018.936	2000	
1800	2074.694	916.712	2077.216	916.740	2079.738	916.771	2082.262	916.803	2084.788	916.837	2087.314	916.873	2089.842	916.911	2092.371	916.950	2094.902	916.991	2097.433	917.034	2099.966	917.078	2102.501	917.125	2105.037	917.173	1800	
1500	1735.639	764.008	1738.165	764.043	1740.693	764.080	1743.221	764.118	1745.751	764.159	1748.283	764.202	1750.817	764.247	1753.352	764.295	1755.888	764.344	1758.426	764.395	1760.966	764.448	1763.507	764.504	1766.050	764.562	1500*	
1200	1396.601	611.327	1399.134	611.371	1401.667	611.417	1404.203	611.465	1406.741	611.516	1409.281	611.570	1411.823	611.626	1414.366	611.685	1416.912	611.747	1419.459	611.811	1422.008	611.877	1424.560	611.947	1427.113	612.019	1200	
1000	1170.592	509.563	1173.131	509.614	1175.671	509.669	1178.214	509.728	1180.760	509.789	1183.307	509.853	1185.857	509.921	1188.409	509.992	1190.964	510.065	1193.521	510.142	1196.080	510.223	1198.641	510.306	1201.204	510.392	1000	
900	1057.596	458.691	1060.138	458.749	1062.684	458.810	1065.231	458.875	1067.782	458.943	1070.334	459.014	1072.890	459.089	1075.448	459.168	1078.008	459.250	1080.571	459.335	1083.136	459.425	1085.704	459.517	1088.275	459.613	900	
800	944.608	407.831	947.156	407.896	949.707	407.965	952.260	408.037	954.816	408.114	957.376	408.195	959.938	408.279	962.503	408.367	965.071	408.459	967.641	408.556	970.214	408.656	972.791	408.760	975.370	408.868	800	
700	831.631	356.987	834.186	357.061	836.744	357.140	839.305	357.223	841.869	357.310	844.437	357.402	847.008	357.499	849.582	357.600	852.159	357.705	854.739	357.815	857.323	357.930	859.910	358.049	862.500	358.172	700	
600	718.672	306.167	721.236	306.253	723.803	306.345	726.374	306.442	728.949	306.544	731.527	306.651	734.110	306.764	736.696	306.882	739.286	307.005	741.879	307.133	744.476	307.266	747.077	307.405	749.682	307.549	600	
500	605.740	255.385	608.316	255.488	610.897	255.598	613.482	255.715	616.071	255.837	618.665	255.966	621.263	256.101	623.866	256.242	626.473	256.390	629.085	256.544	631.701	256.704	634.321	256.871	636.946	257.043	500	
400	492.857	204.670	495.451	204.799	498.051	204.937	500.657	205.082	503.268	205.235	505.884	205.396	508.506	205.565	511.134	205.742	513.766	205.926	516.405	206.118	519.048	206.318	521.697	206.526	524.351	206.742	400	
360	447.726	184.415	450.330	184.559	452.941	184.712	455.558	184.873	458.180	185.043	460.810	185.222	463.445	185.410	466.085	185.605	468.732	185.811	471.385	186.024	474.043	186.246	476.708	186.477	479.378	186.717	360	100 (P)*
350	436.446	179.355	439.053	179.503	441.667	179.660	444.287	179.826	446.913	180.001	449.546	180.185	452.184	180.378	454.829	180.580	457.479	180.790	460.136	181.010	462.799	181.239	465.468	181.476	468.143	181.722	350	
300	380.068	154.089	382.693	154.261	385.325	154.444	387.964	154.638	390.610	154.842	393.263	155.056	395.924	155.281	398.591	155.517	401.265	155.762	403.947	156.018	406.635	156.284	409.330	156.561	412.032	156.848	300	
250	323.744	128.898	326.392	129.105	329.049	129.325	331.714	129.557	334.388	129.802	337.070	130.059	339.760	130.328	342.458	130.610	345.165	130.905	347.880	131.211	350.603	131.531	353.334	131.862	356.073	132.206	250	
230	301.236	118.855	303.897	119.080	306.566	119.318	309.245	119.571	311.933	119.836	314.630	120.115	317.335	120.408	320.050	120.714	322.773	121.034	325.505	121.367	328.245	121.714	330.994	122.074	333.752	122.448	230	80 (P)*
200	267.510	103.841	270.193	104.100	272.887	104.374	275.590	104.664	278.304	104.969	281.028	105.290	283.762	105.626	286.506	105.978	289.259	106.345	292.022	106.728	294.795	107.125	297.577	107.539	300.369	107.968	200	
170	233.846	88.920	236.559	89.224	239.283	89.546	242.020	89.886	244.768	90.245	247.527	90.621	250.298	91.016	253.080	91.429	255.873	91.860	258.677	92.309	261.492	92.776	264.317	93.261	267.153	93.763	170	
155	217.047	81.510	219.778	81.843	222.523	82.196	225.280	82.569	228.050	82.962	230.831	83.374	233.625	83.807	236.431	84.259	239.249	84.731	242.078	85.222	244.919	85.733	247.771	86.264	250.634	86.814	155	65 (P)*
125	183.553	66.853	186.334	67.265	189.131	67.701	191.942	68.162	194.767	68.647	197.607	69.156	200.461	69.690	203.329	70.248	206.210	70.830	209.104	71.435	212.011	72.065	214.931	72.718	217.854	73.395	125	
100	155.814	54.917	158.655	55.430	161.515	55.973	164.391	56.546	167.283	57.148	170.192	57.781	173.117	58.443	176.057	59.135	179.012	59.855	181.981	60.605	184.965	61.384	187.962	62.191	190.972	63.027	100	
90	144.790	50.265	147.663	50.832	150.555	51.433	153.465	52.068	156.392	52.735	159.336	53.434	162.297	54.167	165.273	54.931	168.265	55.727	171.272	56.555	174.293	57.415	177.328	58.305	180.376	59.227	90	50 (P)
80	133.827	45.719	136.737	46.355	139.668	47.028	142.617	47.738	145.585	48.484	148.570	49.267	151.572	50.085	154.591	50.938	157.625	51.827	160.674	52.750	163.737	53.708	166.813	54.699	169.902	55.724	80	50 (H)**
70	122.945	41.324	125.901	42.047	128.878	42.811	131.874	43.616	134.889	44.462	137.922	45.348	140.972	46.274	144.038	47.239	147.119	48.243	150.214	49.284	153.323	50.364	156.444	51.480	159.577	52.632	70	
60	112.177	37.152	115.187	37.987	118.219	38.870	121.270	39.799	124.340	40.774	127.427	41.793	130.530	42.857	133.648	43.964	136.780	45.113	139.924	46.305	143.079	47.537	146.244	48.809	149.417	50.121	60	40 (P)*
55	106.849	35.184	109.890	36.090	112.953	37.046	116.035	38.052	119.134	39.105	122.251	40.206	125.382	41.354	128.526	42.547	131.682	43.785	134.849	45.066	138.025	46.390	141.208	47.755	144.397	49.160	55	
50	101.569	33.325	104.644	34.313	107.739	35.355	110.853	36.449	113.983	37.595	117.128	38.790	120.286	40.034	123.456	41.326	126.634	42.664	129.820	44.048	133.011	45.474	136.207	46.943	139.404	48.452	50	40 (H)**
45	96.345	31.607	99.455	32.693	102.585	33.835	105.731	35.033	108.891	36.286	112.063	37.591	115.244	38.946	118.433	40.351	121.627	41.804	124.824	43.302	128.021	44.844	131.217	46.428	134.410	48.051	45	35 (P)*
40	91.187	30.076	94.333	31.277	97.496	32.540	100.671	33.861	103.856	35.238	107.048	36.670	110.244	38.154	113.442	39.688	116.638	41.269	119.830	42.895							40	30 (H)**
35	86.102	28.797	89.280	30.139	92.469	31.544	95.664	33.009	98.862	34.532	102.058	36.110															35	
33	84.088	28.377	87.277	29.782	90.472	31.251	93.669	32.781	96.865	34.369																	33	30 (P)*
30	81.085	27.869	84.282	29.378	87.478	30.952																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 98 Degrees

$\Delta = 98°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_1	T_s	E_2	T_s	E_3	T_s	E_4	T_s	E_5	T_s	E_6	T_s	E_7	T_s	E_8	T_s	E_9	T_s	E_{10}	T_s	E_{11}	T_s	E_{12}	T_s	E_{13}		
metre																											metre	
2500	2083.421	1310.635	2085.925	1310.640	2888.429	1310.646	2890.934	1310.653	2893.440	1310.661	2895.946	1310.670	2898.456	1310.681	2900.965	1310.693	2903.475	1310.707	2905.986	1310.721	2908.498	1310.737	2911.011	1310.754	2913.525	1310.773	2500	
2200	2538.312	1153.361	2540.816	1153.366	2543.320	1153.372	2545.827	1153.380	2548.333	1153.390	2550.842	1153.400	2553.351	1153.413	2555.861	1153.427	2558.373	1153.442	2560.885	1153.458	2563.399	1153.476	2565.913	1153.496	2568.429	1153.517	2200	
2000	2308.239	1048.511	2310.743	1048.517	2313.249	1048.524	2315.755	1048.532	2318.263	1048.543	2320.772	1048.555	2323.282	1048.568	2325.793	1048.583	2328.306	1048.600	2330.820	1048.618	2333.335	1048.638	2335.851	1048.659	2338.368	1048.683	2000	
1800	2078.166	943.661	2080.671	943.668	2083.177	943.676	2085.684	943.685	2088.193	943.697	2090.703	943.710	2093.214	943.725	2095.727	943.742	2098.240	943.760	2100.756	943.780	2103.273	943.803	2105.790	943.826	2108.309	943.852	1800	
1500	1733.057	786.388	1735.561	786.395	1738.070	786.403	1740.579	786.416	1743.089	786.430	1745.601	786.446	1748.115	786.463	1750.630	786.484	1753.146	786.506	1755.665	786.531	1758.185	786.557	1760.706	786.585	1763.229	786.616	1500	
1200	1387.949	629.114	1390.456	629.124	1392.965	629.135	1395.476	629.150	1397.989	629.167	1400.504	629.187	1403.021	629.209	1405.540	629.235	1408.060	629.262	1410.583	629.293	1413.108	629.326	1415.635	629.362	1418.164	629.400	1200	
1000	1157.877	524.266	1160.386	524.277	1162.897	524.292	1165.410	524.309	1167.925	524.330	1170.443	524.354	1172.963	524.381	1175.486	524.411	1178.011	524.444	1180.538	524.480	1183.068	524.520	1185.600	524.563	1188.135	524.609	1000	
900	1042.842	471.843	1045.352	471.855	1047.864	471.871	1050.378	471.890	1052.895	471.913	1055.415	471.939	1057.937	471.970	1060.462	472.003	1062.990	472.040	1065.521	472.081	1068.054	472.125	1070.589	472.172	1073.128	472.224	900	
800	927.807	419.419	930.317	419.433	932.831	419.451	935.347	419.473	937.866	419.499	940.389	419.529	942.914	419.462	945.442	419.600	947.974	419.642	950.508	419.687	953.045	419.737	955.585	419.791	958.128	419.848	800	
700	812.772	366.997	815.284	367.013	817.799	367.033	820.318	367.058	822.841	367.088	825.366	367.122	827.895	367.160	830.426	367.203	832.962	367.251	835.502	367.303	838.044	367.360	840.589	367.421	843.138	367.487	700	100 (P)*
600	697.738	314.575	700.252	314.594	702.770	314.617	705.292	314.646	707.817	314.681	710.347	314.720	712.881	314.766	715.418	314.816	717.960	314.871	720.505	314.932	723.054	314.999	725.608	315.070	728.165	315.146	600	
500	582.705	261.155	585.222	262.177	587.743	262.205	590.269	262.240	592.800	262.281	595.336	262.329	597.876	262.383	600.421	262.443	602.970	262.510	605.525	262.583	608.084	262.663	610.647	262.748	613.216	262.841	500	
400	467.674	209.737	470.195	209.764	472.721	209.800	475.254	209.844	477.792	209.899	480.337	209.955	482.887	210.022	485.443	210.098	488.005	210.181	490.573	210.272	493.146	210.371	495.725	210.479	498.310	210.594	400	
360	421.662	188.771	424.185	188.802	426.715	188.841	429.251	188.890	431.794	188.947	434.343	189.013	436.899	189.088	439.461	189.172	442.029	189.264	444.604	189.365	447.186	189.476	449.773	189.595	452.367	189.723	360	
300	410.159	183.529	412.683	183.561	415.214	183.602	417.751	183.652	420.295	183.710	422.845	183.778	425.402	183.855	427.967	183.942	430.537	184.037	433.114	184.141	435.698	184.255	438.287	184.377	440.884	184.509	300	
250	352.646	157.321	355.174	157.360	357.709	157.408	360.253	157.466	362.804	157.535	365.363	157.614	367.929	157.704	370.504	157.805	373.085	157.916	375.675	158.037	378.272	158.170	380.877	158.312	383.489	158.466	250	80 (P)*
230	295.135	131.120	297.668	131.165	300.210	131.222	302.762	131.292	305.323	131.374	307.894	131.469	310.474	131.577	313.062	131.698	315.660	131.831	318.267	131.977	320.883	132.136	323.508	132.307	326.141	132.491	230	
200	272.131	120.640	274.667	120.688	277.213	120.750	279.770	120.826	282.336	120.916	284.913	121.020	287.499	121.137	290.095	121.268	292.701	121.413	295.317	121.572	297.942	121.744	300.578	121.930	303.222	122.130	200	
175	237.627	104.922	240.168	104.977	242.721	105.049	245.286	105.136	247.862	105.239	250.450	105.358	253.049	105.493	255.659	105.644	258.281	105.810	260.913	105.993	263.556	106.191	266.211	106.405	268.876	106.634	175	65 (P)*
150	203.125	89.207	205.674	89.272	208.226	89.356	210.812	89.459	213.401	89.580	216.004	89.720	218.620	89.879	221.249	90.056	223.890	90.252	226.545	90.466	229.213	90.699	231.892	90.951	234.585	91.221	150	
135	185.876	81.351	188.429	81.423	190.997	81.515	193.580	81.628	196.178	81.761	198.790	81.914	201.417	82.088	204.058	82.282	206.712	82.497	209.381	82.732	212.064	82.988	214.760	83.263	217.470	83.559	135	
125	151.381	65.646	153.947	65.735	156.531	65.849	159.134	65.989	161.754	66.153	164.392	66.344	167.047	66.559	169.720	66.800	172.409	67.066	175.116	67.357	177.839	67.673	180.578	68.014	183.334	68.380	125	
100	122.683	52.568	125.225	52.679	127.830	52.822	130.456	52.996	133.105	53.202	135.776	53.440	138.468	53.709	141.180	54.009	143.914	54.341	146.667	54.704	149.440	55.098	152.233	55.524	155.044	55.980	100	
90	111.151	47.241	113.742	47.465	116.358	47.623	118.998	47.817	121.663	48.046	124.351	48.310	127.062	48.608	129.797	48.942	132.553	49.310	135.332	49.713	138.132	50.150	140.953	50.622	143.794	51.128	90	50 (P)*
80	99.662	42.119	102.264	42.258	104.893	42.436	107.550	42.654	110.234	42.911	112.944	43.208	115.680	43.543	118.441	43.918	121.226	44.332	124.035	44.784	126.868	45.275	129.723	45.804	132.600	46.371	80	50 (H)**
70	88.177	35.902	90.793	37.060	93.440	37.264	96.118	37.513	98.826	37.807	101.564	38.145	104.330	38.528	107.124	38.956	109.945	39.427	112.792	39.943	115.664	40.502	118.561	41.104	121.482	41.749	70	
60	76.698	31.693	79.332	31.878	82.002	32.116	84.708	32.406	87.448	32.748	90.221	33.142	93.027	33.588	95.863	34.085	98.729	34.633	101.624	35.232	104.547	35.881	107.496	36.579	110.470	37.327	60	40 (P)*
55	70.961	29.093	73.607	29.295	76.292	29.554	79.015	29.870	81.775	30.243	84.570	30.673	87.399	31.158	90.262	31.699	93.155	32.296	96.079	32.947	99.032	33.652	102.012	34.411	105.018	35.222	55	
50	63.228	26.498	67.898	26.720	70.590	27.005	73.333	27.352	76.116	27.762	78.937	28.233	81.795	28.766	84.687	29.360	87.612	30.014	90.569	30.727	93.556	31.499	96.570	32.329	99.611	33.216	50	40 (H)**
45	59.499	21.909	62.175	24.155	64.898	24.471	67.666	24.857	70.476	25.311	73.328	25.834	76.218	26.424	79.145	27.081	82.107	27.804	85.102	28.592	88.127	29.444	91.180	30.359	94.260	31.336	45	35 (P)*
40	53.775	21.327	56.472	21.404	59.220	21.959	62.018	22.392	64.862	22.902	67.749	23.488	70.679	24.149	73.647	24.885	76.651	25.693	79.689	26.573	82.758	27.522	85.854	28.541	88.975	29.626	40	35 (H) 30 (P)*
38	48.059	18.756	50.782	19.073	53.562	19.478	56.396	19.971	59.281	20.552	62.213	21.219	65.189	21.970	68.206	22.804	71.259	23.718	74.346	24.713	77.462	25.784	80.604	26.929	83.768	28.147	35	
35	45.775	17.733	48.511	18.068	51.306	18.497	54.157	19.020	57.061	19.634	60.013	20.340	63.011	21.133	66.049	22.014	69.124	22.980	72.232	24.028	75.368	25.156	78.528	26.361	81.708	27.640	33	
30	42.334	16.203	45.111	16.571	47.931	17.043	50.812	17.616	53.748	18.290	56.735	19.062	59.767	19.929	62.840	20.891	65.949	21.943	69.089	23.082	72.255	24.306	75.441	25.611	78.642	26.993	30	30 (H)**
25	36.667	13.676	39.409	14.117	42.343	14.680	45.265	15.364	48.285	16.164	51.338	17.079	54.457	18.104	57.574	19.235	60.742	20.467	63.933	21.796	67.141	23.214	70.357	24.718	73.574	26.301	25	
23	34.499	12.677	37.224	13.155	40.125	13.760	43.096	14.506	46.127	15.371	49.211	16.359	52.338	17.462	55.501	18.677	58.691	19.997	61.898	21.416	65.114	22.927	68.331	24.523			23	25 (P)*
20	31.009	11.196	33.675	11.744	36.423	12.442	39.845	13.286	42.927	14.270	46.059	15.388	49.230	16.632	52.426	17.995	55.642	19.468	58.859	21.041							20	25 (H)**
18	28.406	8.808	30.367	9.531	31.420	10.445	34.545	11.541	37.720	12.805	40.927	14.224	44.144	15.781													18	20 (P)*
14	24.266	6.350	27.252	9.121	30.360	10.095	33.507	11.259	36.700	12.597	39.915	14.091															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 98 Degrees

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=98°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2916.040	310.792	2918.555	310.813	2921.072	310.836	2923.589	310.859	2926.108	310.884	2928.628	310.910	2931.148	310.937	2933.670	310.966	2936.192	310.996	2938.715	311.027	2941.240	311.059	2943.765	311.093	2946.291	311.128	2500	
2200	2570.946	1153.539	2573.464	1153.563	2575.983	1153.588	2578.503	1153.615	2581.024	1153.643	2583.546	1153.672	2586.069	1153.704	2588.594	1153.736	2591.119	1153.770	2593.646	1153.805	2596.173	1153.842	2598.702	1153.880	2601.231	1153.920	2200	
2000	2340.886	1048.707	2343.406	1048.733	2345.927	1048.761	2348.449	1048.791	2350.972	1048.821	2353.497	1048.854	2356.022	1048.888	2358.549	1048.924	2361.077	1048.961	2363.606	1049.000	2366.136	1049.041	2368.668	1049.083	2371.200	1049.126	2000	
1800	2110.830	943.879	2113.352	943.908	2115.875	943.939	2118.400	943.972	2120.925	944.006	2123.452	944.042	2125.981	944.080	2128.510	944.120	2131.041	944.161	2133.574	944.205	2136.107	944.250	2138.642	944.297	2141.179	944.345	1800	
1500	1765.754	786.649	1768.280	786.684	1770.808	786.721	1773.337	786.760	1775.868	786.802	1778.400	786.844	1780.935	786.890	1783.470	786.938	1786.007	786.988	1788.546	787.040	1791.086	787.094	1793.628	787.149	1796.171	787.208	1500	
1200	1420.694	629.441	1423.227	629.485	1425.761	629.531	1428.298	629.580	1430.837	629.632	1433.377	629.686	1435.920	629.743	1438.464	629.802	1441.010	629.865	1443.559	629.929	1446.109	629.997	1448.661	630.067	1451.215	630.139	1200	
1000	1190.671	524.658	1193.211	524.711	1195.752	524.766	1198.296	524.825	1200.842	524.887	1203.390	524.952	1205.941	525.021	1208.494	525.092	1211.050	525.166	1213.607	525.244	1216.168	525.325	1218.730	525.409	1221.294	525.496	1000	
900	1073.668	472.279	1078.212	472.337	1080.758	472.398	1083.306	472.463	1085.857	472.532	1088.411	472.604	1090.968	472.680	1093.526	472.760	1096.088	472.843	1098.652	472.929	1101.219	473.019	1103.788	473.113	1106.360	473.209	900	
800	960.673	419.909	963.222	419.975	965.774	420.045	968.328	420.118	970.886	420.195	973.447	420.277	976.010	420.362	978.576	420.451	981.145	420.544	983.717	420.642	986.291	420.743	988.869	420.848	991.449	420.957	800	
700	845.690	367.557	848.246	367.632	850.805	367.711	853.367	367.795	855.933	367.884	858.502	367.976	861.074	368.074	863.649	368.176	866.228	368.282	868.810	368.394	871.395	368.509	873.983	368.629	876.575	368.754	700	
600	730.725	315.229	733.290	315.316	735.859	315.408	738.431	315.506	741.007	315.610	743.587	315.718	746.171	315.832	748.759	315.951	751.350	316.075	753.945	316.205	756.544	316.339	759.147	316.479	761.753	316.625	600	
500	615.788	262.939	618.365	263.043	620.948	263.155	623.534	263.272	626.125	263.396	628.721	263.526	631.321	263.662	633.925	263.805	636.534	263.954	639.148	264.109	641.766	264.271	644.388	264.439	647.015	264.614	500	
400	500.900	210.717	503.496	210.847	506.098	210.986	508.706	211.133	511.318	211.288	513.937	211.450	516.561	211.621	519.191	211.799	521.826	211.985	524.467	212.179	527.113	212.382	529.764	212.592	532.422	212.810	400	
360	454.968	189.859	457.574	190.004	460.187	190.159	462.805	190.322	465.430	190.493	468.062	190.674	470.699	190.864	473.343	191.062	475.992	191.269	478.647	191.484	481.309	191.709	483.976	191.942	486.650	192.184	360	100 (P)*
350	443.487	184.649	446.096	184.798	448.712	184.957	451.334	185.125	453.963	185.302	456.598	185.487	459.239	185.682	461.886	185.886	464.539	186.098	467.199	186.320	469.865	186.551	472.537	186.791	475.216	187.040	350	
300	386.108	158.630	388.735	158.804	391.369	158.989	394.011	159.185	396.660	159.390	399.316	159.607	401.979	159.834	404.650	160.072	407.328	160.320	410.012	160.578	412.704	160.847	415.403	161.127	418.109	161.417	300	
250	328.783	132.687	331.435	132.896	334.094	133.118	336.763	133.353	339.440	133.600	342.125	133.859	344.819	134.132	347.521	134.416	350.232	134.714	352.951	135.023	355.678	135.346	358.413	135.681	361.156	136.028	250	
230	305.876	122.343	308.540	122.571	311.213	122.812	313.895	123.066	316.586	123.335	319.287	123.617	321.996	123.912	324.715	124.222	327.442	124.545	330.178	124.881	332.924	125.231	335.677	125.595	338.440	125.972	230	80 (P)*
200	271.552	106.880	274.238	107.141	276.935	107.418	279.643	107.710	282.361	108.019	285.089	108.343	287.827	108.682	290.575	109.038	293.334	109.408	296.102	109.795	298.880	110.197	301.668	110.614	304.465	111.047	200	
170	237.290	91.509	240.007	91.816	242.736	92.141	245.477	92.485	248.229	92.847	250.994	93.228	253.770	93.626	256.557	94.043	259.356	94.479	262.166	94.932	264.987	95.404	267.819	95.893	270.662	96.401	170	
155	220.193	83.875	222.929	84.212	225.678	84.568	228.440	84.945	231.215	85.341	234.002	85.758	236.802	86.195	239.614	86.651	242.438	87.128	245.274	87.624	248.121	88.140	250.980	88.676	253.851	89.232	155	65 (P)*
125	186.105	68.771	188.892	69.187	191.694	69.628	194.511	70.093	197.343	70.583	200.190	71.098	203.051	71.637	205.926	72.200	208.815	72.788	211.717	73.400	214.633	74.036	217.561	74.695	220.503	75.379	125	
100	157.874	56.467	160.723	56.984	163.589	57.533	166.473	58.111	169.374	58.720	172.291	59.359	175.224	60.027	178.173	60.726	181.138	61.454	184.117	62.211	187.111	62.998	190.119	63.813	193.141	64.658	100	
90	146.656	51.667	149.536	52.241	152.436	52.848	155.354	53.488	158.290	54.162	161.244	54.869	164.214	55.608	167.201	56.380	170.204	57.185	173.221	58.021	176.254	58.889	179.301	59.788	182.361	60.719	90	50 (P)
80	135.499	46.976	138.418	47.618	141.358	48.298	144.316	49.015	147.294	49.769	150.290	50.559	153.303	51.386	156.332	52.248	159.378	53.145	162.439	54.078	165.515	55.045	168.605	56.046	171.708	57.082	80	50 (H)**
70	124.426	41.437	127.391	43.167	130.378	43.939	133.385	44.753	136.411	45.607	139.456	46.502	142.518	47.437	145.597	48.412	148.691	49.425	151.801	50.477	154.924	51.567	158.060	52.695	161.208	53.859	70	
60	113.469	38.123	116.491	38.967	119.534	39.859	122.597	40.797	125.680	41.782	128.781	42.811	131.898	43.885	135.031	45.004	138.178	46.165	141.338	47.368	144.509	48.612	147.691	49.897	150.882	51.222	60	40 (P)*
55	108.049	36.086	111.102	37.001	114.177	37.967	117.272	38.982	120.386	40.046	123.517	41.158	126.663	42.318	129.824	43.523	132.996	44.773	136.180	46.067	139.374	47.404	142.575	48.782	145.782	50.201	55	
50	102.677	34.159	105.765	35.157	108.874	36.209	112.003	37.314	115.148	38.471	118.309	39.678	121.484	40.935	124.670	42.240	127.867	43.591	131.071	44.988	134.281	46.429	137.496	47.912	140.713	49.437	50	40 (H)**
45	97.364	32.373	100.489	33.470	103.634	34.623	106.795	35.834	109.972	37.099	113.161	38.416	116.361	39.786	119.568	41.205	122.782	42.672	125.998	44.185	129.216	45.742	132.433	47.342	135.647	48.982	45	35 (P)*
40	92.119	30.776	95.281	31.990	98.461	33.265	101.653	34.599	104.857	35.990	108.068	37.437	111.284	38.936	114.501	40.485	117.719	42.082	120.932	43.724							40	30 (H)**
35	86.950	29.435	90.147	39.790	93.354	32.209	96.569	33.689	99.787	35.228	103.004	36.821															35	
33	84.904	28.991	88.112	30.410	91.326	31.894	94.544	33.439	97.761	35.043																	33	30 (P)*
30	81.854	28.448	85.072	29.972	88.289	31.561																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 99 Degrees

$\Delta = 99°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2954.624	1349.426	2937.127	1349.431	2939.632	1349.437	2942.137	1349.443	2944.644	1349.452	2947.151	1349.461	2949.659	1349.472	2952.169	1349.485	2954.679	1349.498	2957.190	1349.513	2959.702	1349.529	2962.215	1349.546	2964.729	1349.565	2500	
2200	2583.370	1187.497	2585.874	1187.502	2588.379	1187.508	2590.885	1187.516	2593.393	1187.526	2595.901	1187.537	2598.410	1187.549	2600.921	1187.563	2603.432	1187.578	2605.945	1187.595	2608.459	1187.613	2610.974	1187.633	2613.490	1187.654	2200	
2000	2349.201	1079.544	2351.706	1079.549	2354.211	1079.556	2356.718	1079.565	2359.226	1079.576	2361.735	1079.588	2364.245	1079.602	2366.757	1079.616	2369.269	1079.634	2371.783	1079.652	2374.299	1079.672	2376.815	1079.694	2379.333	1079.717	2000	
1800	2115.032	971.591	2117.537	971.597	2120.043	971.605	2122.551	971.615	2125.059	971.626	2127.570	971.640	2130.081	971.655	2132.594	971.672	2135.108	971.691	2137.624	971.711	2140.141	971.734	2142.659	971.758	2145.178	971.783	1800	
1600	1763.779	809.662	1766.285	809.670	1768.792	809.679	1771.301	809.691	1773.812	809.705	1776.324	809.721	1778.837	809.739	1781.353	809.759	1783.870	809.782	1786.389	809.806	1788.909	809.833	1791.431	809.862	1793.954	809.893	1600	
1200	1412.527	647.734	1415.034	647.743	1417.543	647.755	1470.054	647.770	1422.567	647.787	1425.083	647.808	1427.600	647.830	1430.119	647.856	1432.640	647.884	1435.163	647.914	1437.688	647.948	1440.216	647.984	1442.745	648.023	1200	
1000	1178.359	539.782	1180.867	539.794	1183.378	539.808	1185.892	539.826	1188.407	539.847	1190.926	539.871	1193.446	539.898	1195.969	539.929	1198.495	539.962	1201.022	539.999	1203.553	540.039	1206.085	540.083	1208.621	540.129	1000	
900	1061.275	485.808	1063.785	485.820	1066.297	485.836	1068.812	485.856	1071.329	485.879	1073.849	485.905	1076.372	485.936	1078.898	485.969	1081.427	486.007	1083.957	486.048	1086.491	486.093	1089.027	486.141	1091.566	486.192	900	
800	944.192	431.833	946.703	431.846	949.216	431.865	951.733	431.887	954.253	431.913	956.775	431.943	959.301	431.977	961.830	432.015	964.362	432.057	966.896	432.103	969.434	432.153	971.975	432.208	974.519	432.266	800	
700	827.109	377.858	829.622	377.875	832.137	377.895	834.656	377.920	837.179	377.950	839.705	377.984	842.234	378.023	844.767	378.067	847.303	378.115	849.843	378.168	852.385	378.225	854.932	378.287	857.482	378.353	700	100 (P)*
600	710.027	323.885	712.541	323.904	715.059	323.928	717.582	323.957	720.108	323.992	722.638	324.032	725.172	324.077	727.710	324.128	730.253	324.184	732.799	324.246	735.349	324.313	737.903	324.385	740.461	324.462	600	
500	592.946	269.913	595.463	269.936	597.985	269.964	600.511	270.000	603.043	270.041	605.579	270.089	608.120	270.144	610.666	270.203	613.216	270.272	615.771	270.346	618.332	270.426	620.896	270.513	623.466	270.606	500	
400	475.867	215.943	478.388	215.972	480.913	216.008	483.448	216.052	485.988	216.104	488.533	216.164	491.084	216.232	493.641	216.308	496.204	216.392	498.773	216.485	501.347	216.585	503.927	216.693	506.514	216.809	400	
360	429.036	194.357	431.559	194.388	434.089	194.428	436.626	194.477	439.170	194.535	441.720	194.602	444.277	194.677	446.840	194.762	449.410	194.856	451.986	194.958	454.569	195.069	457.158	195.189	459.754	195.319	360	
350	417.328	188.960	419.852	188.992	422.384	189.033	424.921	189.084	427.466	189.143	430.018	189.212	432.576	189.290	435.141	189.377	437.713	189.473	440.291	189.579	442.876	189.693	445.468	189.817	448.066	189.950	350	
300	358.791	161.979	361.319	162.016	363.855	162.064	366.399	162.123	368.952	162.192	371.511	162.272	374.080	162.364	376.655	162.465	379.238	162.577	381.830	162.700	384.428	162.834	387.035	162.978	389.649	163.133	300	80 (P)*
250	300.256	135.000	302.790	135.045	305.333	135.103	307.886	135.173	310.448	135.256	313.020	135.353	315.601	135.462	318.191	135.583	320.791	135.718	323.400	135.865	326.018	136.026	328.645	136.199	331.281	136.385	250	
230	276.843	124.209	279.379	124.258	281.926	124.321	284.484	124.398	287.051	124.488	289.629	124.593	292.217	124.711	294.815	124.844	297.423	124.990	300.041	125.150	302.669	125.324	305.306	125.512	307.954	125.714	230	
200	241.724	108.026	244.266	108.082	246.820	108.154	249.386	108.242	251.964	108.346	254.553	108.467	257.154	108.603	259.766	108.755	262.390	108.923	265.024	109.108	267.671	109.308	270.328	109.524	272.996	109.756	200	
170	206.608	91.945	209.158	91.972	211.721	91.996	214.298	92.100	216.889	92.223	219.494	92.364	222.112	92.524	224.743	92.703	227.387	92.901	230.045	93.118	232.715	93.353	235.399	93.602	238.095	93.880	170	65 (P)*
185	189.032	83.757	191.606	83.830	194.175	83.923	196.760	84.036	199.359	84.171	201.974	84.326	204.603	84.502	207.246	84.698	209.904	84.915	212.576	85.152	215.262	85.410	217.961	85.689	220.675	85.987	185	
125	131.943	67.587	156.510	67.676	159.096	67.792	161.700	67.933	164.322	68.099	166.963	68.291	169.621	68.509	172.297	68.752	174.990	69.021	177.701	69.315	180.428	69.634	183.172	69.979	185.932	70.349	125	
100	124.693	54.121	127.277	54.233	129.881	54.378	132.512	54.554	135.164	54.762	137.838	55.002	140.533	55.274	143.250	55.577	145.987	55.912	148.746	56.279	151.524	56.677	154.322	57.107	157.140	57.568	100	
90	112.997	48.739	115.589	48.864	118.207	49.024	120.850	49.220	123.517	49.451	126.209	49.718	128.925	50.019	131.664	50.356	134.425	50.728	137.209	51.135	140.015	51.577	142.842	52.053	145.691	52.564	90	30 (P)*
80	101.303	43.362	103.906	43.502	106.538	43.682	109.198	43.902	111.886	44.162	114.600	44.462	117.340	44.801	120.106	45.179	122.897	45.597	125.712	46.054	128.551	46.550	131.413	47.084	134.298	47.657	80	50 (H)**
70	89.613	37.990	92.231	38.150	94.881	38.356	97.563	38.607	100.275	38.904	103.017	39.246	105.788	39.633	108.588	40.065	111.415	40.541	114.269	41.062	117.149	41.626	120.054	42.235	122.984	42.887	70	
60	77.920	32.627	80.567	32.813	83.240	33.053	85.950	33.346	88.694	33.692	91.473	34.090	94.284	34.541	97.127	35.043	100.001	35.597	102.904	36.201	105.835	36.857	108.794	37.562	111.778	38.316	60	40 (P)*
55	72.091	29.950	74.740	30.153	77.423	30.415	80.156	30.734	82.920	31.111	85.721	31.545	88.557	32.035	91.427	32.582	94.328	33.185	97.261	33.842	100.223	34.555	103.213	35.321	106.230	36.141	55	
50	66.266	27.277	68.919	27.501	71.625	27.789	74.373	28.140	77.161	28.553	79.988	29.030	82.853	29.568	85.753	30.168	88.687	30.828	91.654	31.549	94.651	32.329	97.677	33.167	100.730	34.063	50	40 (H)**
45	60.425	24.610	62.105	24.859	65.832	25.178	68.605	25.568	71.421	26.027	74.280	26.555	77.178	27.151	80.114	27.815	83.085	28.545	86.091	29.341	89.127	30.202	92.193	31.127	95.286	32.113	45	35 (P)*
40	54.599	21.931	57.300	22.221	60.053	22.590	62.856	23.027	65.707	23.542	68.602	24.134	71.541	24.802	74.519	25.545	77.534	26.362	80.584	27.250	83.665	28.210	86.775	29.239	89.911	30.335	40	35 (H) 30 (P)*
35	48.781	19.304	51.508	19.623	54.294	20.032	57.135	20.531	60.027	21.117	62.968	21.791	65.955	22.550	68.982	23.392	72.048	24.316	75.148	25.320	78.279	26.402	81.436	27.560	84.616	28.790	35	
33	46.457	18.249	49.197	18.583	51.998	19.021	54.856	19.549	57.768	20.170	60.730	20.883	63.738	21.685	66.788	22.574	69.876	23.550	72.998	24.608	76.149	25.748	79.326	26.965	82.523	28.257	33	
30	42.935	16.673	45.736	17.045	48.564	17.521	51.452	18.101	54.397	18.781	57.394	19.561	60.438	20.438	63.524	21.409	66.647	22.471	69.802	23.623	72.984	24.859	76.188	26.177	79.408	27.573	30	30 (H)**
25	37.186	14.078	39.904	14.515	42.677	15.084	45.527	15.774	48.838	16.583	51.904	17.508	55.016	18.543	58.169	19.686	61.353	20.930	64.562	22.272	67.788	23.705	71.025	25.224	74.263	26.823	25	
23	34.878	13.060	37.710	13.523	40.619	14.140	43.600	14.887	46.642	15.762	49.739	16.759	52.882	17.874	56.061	19.101	59.268	20.435	62.495	21.868	65.731	23.394	68.970	25.006			23	25 (P)*
20	31.428	11.514	34.301	12.067	37.259	12.773	40.292	13.625	43.387	14.619	46.535	15.748	49.732	17.015	52.979	18.392	56.272	19.870	59.611	21.459							20	25 (H)**
15	25.726	9.050	28.697	9.780	31.702	10.704	34.901	11.811	38.094	13.089	41.320	14.521	44.558	16.094													15	20 (P)*
14	24.597	8.577	27.593	9.357	30.684	10.341	33.847	11.516	37.057	12.867	40.292	14.377															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 99 Degrees

$\Delta = 99°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	2967.244	1349.585	2969.760	1349.606	2972.277	1349.628	2974.795	1349.652	2977.314	1349.677	2979.834	1349.704	2982.355	1349.731	2984.877	1349.760	2987.399	1349.790	2989.924	1349.822	2992.448	1349.854	2994.974	1349.888	2997.500	1349.924	2500	
2200	2616.007	1187.677	2618.525	1187.701	2621.044	1187.726	2623.565	1187.753	2626.086	1187.782	2628.609	1187.812	2631.133	1187.843	2633.657	1187.876	2636.183	1187.910	2638.710	1187.946	2641.238	1187.983	2643.767	1188.022	2646.297	1188.062	2200	
2000	2381.851	1079.742	2384.371	1079.768	2386.893	1079.796	2389.415	1079.826	2391.939	1079.857	2394.464	1079.890	2396.990	1079.925	2399.517	1079.960	2402.045	1079.999	2404.575	1080.038	2407.106	1080.079	2409.638	1080.121	2412.171	1080.165	2000	
1800	2147.699	971.811	2150.221	971.840	2152.745	971.872	2155.270	971.905	2157.796	971.939	2160.323	971.976	2162.852	972.014	2165.383	972.054	2167.914	972.096	2170.447	972.140	2172.981	972.185	2175.517	972.232	2178.054	972.281	1800	
1500	1796.479	809.926	1799.006	809.961	1801.534	809.999	1804.064	810.038	1806.595	810.080	1809.128	810.124	1811.663	810.170	1814.199	810.218	1816.737	810.268	1819.276	810.321	1821.817	810.375	1824.360	810.432	1826.904	810.491	1500	
1200	1445.226	648.064	1447.810	648.108	1450.344	648.155	1452.882	648.204	1455.421	648.256	1457.962	648.311	1460.506	648.369	1463.051	648.429	1465.598	648.492	1468.147	648.557	1470.698	648.625	1473.251	648.696	1475.806	648.770	1200	
1000	1211.158	540.179	1213.698	540.232	1216.240	540.288	1218.784	540.347	1221.332	540.410	1223.881	540.475	1226.433	540.544	1228.987	540.617	1231.543	540.692	1234.102	540.771	1236.663	540.852	1239.227	540.937	1241.792	541.025	1000	
900	1094.107	486.248	1096.652	486.306	1099.198	486.369	1101.748	486.435	1104.300	486.504	1106.855	486.577	1109.412	486.654	1111.972	486.734	1114.535	486.818	1117.100	486.905	1119.668	486.996	1122.238	487.090	1124.811	487.188	900	
800	977.065	432.328	979.615	432.394	982.168	432.464	984.723	432.538	987.281	432.616	989.843	432.699	992.407	432.785	994.975	432.875	997.545	432.969	1000.118	433.068	1002.694	433.169	1005.273	433.276	1007.855	433.386	800	
700	860.035	378.424	862.592	378.500	865.152	378.580	867.715	378.665	870.282	378.754	872.852	378.848	875.425	378.946	878.002	379.050	880.582	379.157	883.166	379.269	885.752	379.386	888.342	379.508	890.936	379.634	700	
600	743.023	324.545	745.589	324.634	748.159	324.727	750.732	324.826	753.310	324.930	755.891	325.040	758.477	325.155	761.066	325.275	763.659	325.400	766.256	325.531	768.857	325.667	771.461	325.809	774.070	325.956	600	
500	626.040	270.705	628.618	270.811	631.202	270.923	633.790	271.042	636.383	271.167	638.980	271.298	641.582	271.436	644.188	271.580	646.800	271.731	649.415	271.888	652.035	272.051	654.660	272.221	657.289	272.397	500	
400	509.106	216.934	511.704	217.065	514.307	217.206	516.917	217.354	519.532	217.510	522.153	217.675	524.779	217.847	527.412	218.027	530.049	218.215	532.692	218.411	535.341	218.615	537.996	218.827	540.656	219.048	400	
360	462.356	195.457	464.864	195.603	467.379	195.759	470.200	195.924	472.827	196.097	475.461	196.280	478.101	196.471	480.747	196.671	483.399	196.880	486.058	197.098	488.722	197.325	491.393	197.560	494.070	197.805	360	100 (P)*
350	450.671	190.091	453.282	190.242	455.900	190.403	458.525	190.572	461.156	190.751	463.793	190.938	466.437	191.135	469.087	191.341	471.743	191.556	474.406	191.780	477.075	192.013	479.750	192.255	482.432	192.507	350	
300	392.271	163.298	394.900	163.474	397.537	163.661	400.181	163.859	402.833	164.067	405.492	164.286	408.158	164.515	410.832	164.755	413.513	165.005	416.201	165.267	418.896	165.539	421.599	165.821	424.309	166.114	300	
250	333.926	136.583	336.579	136.794	339.242	137.018	341.914	137.255	344.594	137.505	347.283	137.767	349.980	138.042	352.687	138.330	355.401	138.630	358.124	138.943	360.856	139.269	363.596	139.607	366.344	139.958	250	
230	310.611	125.930	313.277	126.160	315.953	126.403	318.639	126.660	321.334	126.931	324.038	127.216	326.751	127.515	329.474	127.827	332.206	128.154	334.947	128.494	337.697	128.847	340.456	129.215	343.223	129.596	230	80 (P)*
200	275.675	110.004	278.365	110.268	281.066	110.547	283.777	110.843	286.500	111.154	289.232	111.482	291.975	111.825	294.728	112.184	297.491	112.558	300.265	112.948	303.048	113.354	305.842	113.776	308.645	114.214	200	
170	240.803	94.171	243.525	94.481	246.258	94.810	249.004	95.157	251.761	95.523	254.531	95.907	257.312	96.310	260.105	96.731	262.910	97.171	265.726	97.629	268.553	98.105	271.392	98.600	274.241	99.113	170	
155	223.402	86.307	226.143	86.647	228.897	87.007	231.664	87.387	234.444	87.788	237.237	88.209	240.043	88.650	242.861	89.111	245.691	89.593	248.534	90.094	251.388	90.615	254.254	91.157	257.133	91.718	155	65 (P)*
125	188.709	70.744	191.501	71.164	194.309	71.609	197.132	72.079	199.971	72.574	202.825	73.094	205.693	73.639	208.575	74.208	211.472	74.801	214.383	75.419	217.307	76.062	220.244	76.728	223.195	77.419	125	
100	159.977	58.059	162.832	58.582	165.706	59.136	168.597	59.721	171.506	60.336	174.432	60.981	177.375	61.656	180.333	62.362	183.307	63.098	186.297	63.863	189.301	64.657	192.320	65.481	195.353	66.334	100	
90	148.559	53.109	151.448	53.689	154.356	54.302	157.282	54.949	160.228	55.630	163.191	56.344	166.171	57.091	169.168	57.870	172.181	58.683	175.210	59.528	178.254	60.404	181.313	61.313	184.386	62.253	90	50 (P)
80	137.205	48.268	140.133	48.918	143.081	49.604	146.050	50.329	149.038	51.090	152.044	51.888	155.068	52.723	158.109	53.594	161.167	54.500	164.241	55.442	167.330	56.420	170.433	57.431	173.550	58.477	80	30 (H)**
70	125.937	43.582	128.912	44.319	131.909	45.099	134.927	45.921	137.965	46.784	141.021	47.688	144.096	48.632	147.188	49.617	150.296	50.641	153.420	51.704	156.557	52.805	159.708	53.944	162.872	55.120	70	
60	114.787	39.122	117.820	39.975	120.875	40.875	123.952	41.823	127.048	42.818	130.162	43.858	133.294	44.943	136.442	46.072	139.605	47.245	142.781	48.461	145.969	49.718	149.168	51.016	152.376	52.354	60	40 (P)*
55	109.272	37.013	112.338	37.938	115.426	38.913	118.535	39.939	121.663	41.014	124.809	42.137	127.971	43.308	131.147	44.526	134.337	45.789	137.538	47.096	140.750	48.446	143.969	49.839	147.196	51.272	55	
50	103.808	35.015	106.909	36.024	110.033	37.086	113.176	38.203	116.337	39.371	119.514	40.591	122.706	41.860	125.910	43.179	129.124	44.544	132.347	45.955	135.577	47.411	138.812	48.909	142.049	50.449	50	40 (H)**
45	98.403	33.161	101.543	34.268	104.703	35.434	107.882	36.657	111.075	37.934	114.282	39.266	117.500	40.649	120.737	42.082	123.960	43.564	127.197	45.093	130.436	46.666	133.674	48.282	136.910	49.939	45	35 (P)*
40	93.070	31.497	96.249	32.723	99.445	34.011	102.656	35.359	105.878	36.764	109.108	38.225	112.344	39.739	115.583	41.304	118.822	42.917	122.057	44.576							40	30 (H)**
35	87.816	30.091	91.031	31.460	94.257	32.893	97.492	34.389	100.730	35.943	103.969	37.553															35	
33	85.737	29.622	88.964	31.055	92.198	32.554	95.437	34.116	98.675	35.735																	33	30 (P)*
30	82.640	29.043	85.877	30.583	89.116	32.188																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 100 Degrees

△=100°

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	2986.885	1389.314	2989.389	1389.318	2991.894	1389.324	2994.399	1389.331	2996.906	1389.340	2999.413	1389.349	3001.921	1389.360	3004.431	1389.373	3006.941	1389.387	3009.452	1389.401	3011.965	1389.417	3014.478	1389.435	3016.993	1389.454	2500	
2200	2629.360	1222.597	2631.864	1222.603	2634.369	1222.609	2636.876	1222.618	2639.383	1222.627	2641.891	1222.638	2644.401	1222.651	2646.912	1222.665	2649.424	1222.680	2651.936	1222.697	2654.450	1222.716	2656.966	1222.735	2659.482	1222.757	2200	
2000	2391.010	1111.454	2393.515	1111.459	2396.020	1111.467	2398.527	1111.476	2401.035	1111.486	2403.545	1111.499	2406.055	1111.512	2408.567	1111.527	2411.080	1111.544	2413.594	1111.563	2416.110	1111.583	2418.626	1111.605	2421.144	1111.629	2000	
1800	2152.660	1000.310	2155.166	1000.316	2157.672	1000.324	2160.179	1000.334	2162.688	1000.346	2165.198	1000.359	2167.710	1000.375	2170.223	1000.392	2172.738	1000.411	2175.253	1000.431	2177.771	1000.454	2180.289	1000.478	2182.809	1000.504	1800	
1500	1795.136	833.595	1797.642	833.602	1800.149	833.612	1802.658	833.624	1805.169	833.638	1807.682	833.654	1810.195	833.672	1812.711	833.693	1815.229	833.715	1817.748	833.740	1820.268	833.768	1822.790	833.797	1825.314	833.828	1500	
1200	1437.612	666.880	1440.119	666.889	1442.629	666.902	1445.140	666.917	1447.654	666.934	1450.169	666.954	1452.687	666.977	1455.206	667.003	1457.728	667.031	1460.251	667.062	1462.777	667.096	1465.305	667.133	1467.834	667.172	1200	
1000	1199.263	555.738	1201.772	555.749	1204.283	555.764	1206.797	555.782	1209.313	555.802	1211.832	555.827	1214.353	555.854	1216.876	555.885	1219.402	555.919	1221.930	555.956	1224.461	555.997	1226.994	556.041	1229.530	556.088	1000	
900	1080.090	500.167	1082.599	500.180	1085.112	500.196	1087.627	500.216	1090.145	500.239	1092.665	500.266	1095.188	500.297	1097.714	500.331	1100.243	500.369	1102.775	500.410	1105.309	500.455	1107.846	500.504	1110.385	500.556	900	
800	960.916	444.597	963.427	444.611	965.941	444.629	968.458	444.651	970.978	444.678	973.501	444.708	976.027	444.743	978.556	444.781	981.089	444.823	983.624	444.870	986.162	444.921	988.704	444.975	991.248	445.034	800	
700	841.743	389.027	844.355	389.043	846.774	389.064	849.290	389.089	851.813	389.120	854.340	389.154	856.870	389.194	859.403	389.238	861.940	389.286	864.480	389.340	867.024	389.397	869.572	389.460	872.122	389.527	700	100 (P)*
600	722.570	333.458	725.085	333.477	727.603	333.501	730.126	333.531	732.652	333.566	735.183	333.607	737.718	333.653	740.257	333.704	742.800	333.760	745.347	333.823	747.898	333.890	750.453	333.963	753.012	334.042	600	
500	603.399	277.891	605.916	277.914	608.438	277.942	610.965	277.978	613.497	278.020	616.034	278.069	618.576	278.124	621.122	278.186	623.674	278.254	626.230	278.328	628.791	278.409	631.357	278.497	633.928	278.591	500	
400	484.229	222.326	486.750	222.354	489.278	222.391	491.812	222.435	494.352	222.488	496.898	222.549	499.450	222.617	502.008	222.695	504.572	222.779	507.142	222.873	509.718	222.974	512.300	223.083	514.888	223.208	400	
360	436.562	200.101	439.086	200.133	441.616	200.173	444.154	200.222	446.698	200.281	449.250	200.348	451.807	200.425	454.372	200.510	456.943	200.605	459.521	200.708	462.104	200.821	464.696	200.942	467.293	201.073	360	
350	424.645	194.545	427.170	194.577	429.702	194.619	432.240	194.670	434.786	194.730	437.338	194.799	439.897	194.878	442.464	194.966	445.037	195.063	447.617	195.170	450.203	195 286	452.796	195.410	455.397	195.545	350	
300	365.063	166.766	367.592	166.803	370.129	166.852	372.674	166.911	375.227	166.982	377.788	167.063	380.357	167.155	382.934	167.257	385.518	167.370	388.111	167.494	390.712	167.630	393.321	167.775	395.937	167.932	300	80 (P)*
250	305.483	138.989	308.017	139.034	310.561	139.093	313.115	139.164	315.678	139.248	318.252	139.345	320.834	139.456	323.426	139.579	326.028	139.715	328.638	139.864	331.259	140.026	333.888	140.200	336.526	140.388	250	
230	281.651	127.880	284.189	127.929	286.737	127.992	289.295	128.070	291.864	128.162	294.443	128.267	297.033	128.387	299.633	128.521	302.243	128.668	304.863	128.830	307.492	129.006	310.133	129.196	312.783	129.400	230	
200	245.906	111.218	248.449	111.274	251.004	111.347	253.571	111.436	256.150	111.542	258.741	111.663	261.344	111.801	263.958	111.954	266.584	112.125	269.221	112.311	271.870	112.513	274.530	112.731	277.201	112.966	200	
170	210.163	94.559	212.714	94.625	215.278	94.711	217.857	94.816	220.449	94.940	223.056	95.083	225.676	95.245	228.310	95.426	230.957	95.625	233.617	95.844	236.291	96.082	238.978	96.338	241.677	96.614	170	65 (P)*
155	192.293	86.231	194.848	86.304	197.419	86.398	200.005	86.513	202.606	86.649	205.223	86.806	207.854	86.983	210.500	87.182	213.161	87.401	215.836	87.641	218.525	87.901	221.229	88.183	223.947	88.485	155	
125	156.558	69.582	159.126	69.675	161.713	69.789	164.319	69.932	166.944	70.106	169.587	70.294	172.248	70.514	174.927	70.760	177.624	71.031	180.339	71.328	183.070	71.651	185.819	71.999	188.584	72.373	125	
100	126.786	55.718	129.370	55.832	131.979	55.977	134.611	56.155	137.265	56.366	139.942	56.608	142.641	56.883	145.362	57.189	148.104	57.528	150.867	57.898	153.651	58.301	156.455	58.735	159.279	59.200	100	
90	114.880	50.177	117.474	50.303	120.094	50.465	122.740	50.663	125.411	50.896	128.106	51.165	130.826	51.470	133.569	51.811	136.336	52.187	139.125	52.598	141.937	53.044	144.771	53.525	147.626	54.041	90	50 (P)*
80	102.978	44.640	105.583	44.782	108.218	44.964	110.881	45.186	113.571	45.449	116.290	45.751	119.034	46.094	121.805	46.476	124.602	46.899	127.423	47.360	130.269	47.861	133.139	48.401	136.031	48.980	80	50 (H)**
70	91.079	39.109	93.699	39.271	96.352	39.479	99.037	39.733	101.753	40.032	104.500	40.378	107.277	40.769	110.082	41.205	112.916	41.686	115.777	42.213	118.665	42.783	121.578	43.398	124.516	44.056	70	
60	79.187	33.586	81.827	33.775	84.504	34.018	87.217	34.314	89.966	34.663	92.750	35.065	95.568	35.520	98.417	36.028	101.299	36.587	104.210	37.198	107.150	37.860	110.118	38.573	113.113	39.336	60	40 (P)*
55	73.245	30.830	75.896	31.036	78.588	31.300	81.320	31.623	84.089	32.003	86.896	32.442	89.739	32.937	92.616	33.490	95.526	34.098	98.467	34.763	101 439	35 483	104.440	36.257	107.468	37.085	55	
50	67.305	28.078	69.971	28.304	72.681	28.595	75.434	28.949	78.228	29.367	81.064	29.849	83.933	30.393	86.842	30.998	89.785	31.666	92.761	32.394	95.768	33.182	98.806	34.029	101.871	34.934	50	40 (H)**
45	61.370	25.331	64.053	25.583	66.785	25.905	69.563	26.299	72.385	26.763	75.251	27.296	78.157	27.899	81.102	28.569	84.084	29.307	87 100	30.112	90.148	30.981	93.227	31.915	96.333	32.912	45	35 (P)*
40	55.440	22.593	58.145	22.876	60.903	23.238	63.712	23.680	66.569	24.201	69.473	24.799	72.421	25.474	75.409	26.224	78.435	27.049	81 497	27 947	84.591	28.917	87.715	29.956	90.866	31.064	40	35 (H) 30 (P)*
35	49.519	19.866	52.250	20.189	55.041	20.603	57.888	21.106	60.789	21.699	63.739	22.379	66.736	23.146	69.775	23.997	72.853	24.931	75.967	25.945	79.112	27.039	82.285	28.208	85.482	29.451	35	
33	47.153	18.780	49.897	19.122	52.704	19.560	55.569	20.094	58.490	20.721	61.462	21.441	64.481	22.251	67.543	23.150	70.644	24 136	73 780	25 205	76.947	26.356	80 140	27.586	83.355	28.892	33	
30	43.609	17.157	46.375	17.533	49.209	18.014	52.105	18.599	55.059	19.287	58.067	20.075	61.122	20.960	64.222	21.941	67.359	23.015	70.530	24.178	73.729	25.428	76.951	26 759	80.190	28.170	30	30 (H)**
25	37.717	14.475	40.537	14.924	43.421	15.499	46.380	16.197	49.403	17.014	52.481	17.948	55.605	18.994	58.775	20.149	61.977	21.406	65.204	22.762	68.450	24.210	71.707	25.745	74.967	27.360	25	
23	35 368	13.413	38.205	13.901	41.123	14.525	44.114	15.280	47.169	16.164	50.279	17.171	53.437	18.298	56.633	19.538	59.858	20.885	63.104	22.333	66 361	23.875	69.622	25.504			23	25 (P)*
20	31.856	11.840	34.737	12.399	37.704	13.112	40.748	13.974	43.857	14.978	47.020	16.119	50.225	17.380	53.460	18.750	56.713	20.283	59.974	21.888							20	25 (H)**
15	26.052	9.300	29.033	10.037	32.111	10.971	35.263	12.089	38.475	13.380	41.721	14.827	44.980	16.416													15	20 (P)*
14	24.903	8.811	27.910	9.599	31.014	10.593	34.193	11.781	37.422	13.146	40.677	14.671															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle — 100 Degrees

$\Delta = 100°$

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	3019.505	1389.474	3022.024	1389.495	3024.542	1389.518	3027.060	1389.542	3029.579	1389.567	3032.099	1389.594	3034.620	1389.622	3037.143	1389.651	3039.666	1389.681	3042.190	1389.713	3044.715	1389.746	3047.241	1389.781	3049.769	1389.816	2500	
2200	2661.999	1222.779	2664.518	1222.804	2667.037	1222.830	2669.558	1222.857	2672.080	1222.886	2674.603	1222.916	2677.127	1222.948	2679.653	1222.981	2682.179	1223.015	2684.706	1223.051	2687.235	1223.089	2689.765	1223.128	2692.295	1223.168	2200	
2000	2423.653	1111.654	2426.184	1111.681	2428.705	1111.709	2431.228	1111.739	2433.752	1111.770	2436.277	1111.804	2438.804	1111.839	2441.332	1111.875	2443.861	1111.913	2446.391	1111.953	2448.922	1111.994	2451.455	1112.037	2453.989	1112.082	2000	
1800	2185.330	1000.532	2187.853	1000.562	2190.377	1000.594	2192.902	1000.627	2195.429	1000.662	2197.957	1000.699	2200.486	1000.737	2203.017	1000.778	2205.549	1000.820	2208.083	1000.864	2210.618	1000.910	2213.154	1000.958	2215.692	1001.007	1800	
1500	1827.840	833.861	1830.367	833.897	1832.896	833.935	1835.426	833.975	1837.958	834.017	1840.491	834.061	1843.027	834.108	1845.564	834.156	1848.102	834.207	1850.642	834.260	1853.184	834.315	1855.727	834.372	1858.272	834.432	1500	
1200	1470.366	667.213	1472.900	667.258	1475.436	667.305	1477.974	667.355	1480.514	667.408	1483.056	667.463	1485.600	667.521	1488.146	667.582	1490.694	667.646	1493.244	667.712	1495.796	667.781	1498.350	667.852	1500.906	667.926	1200	
1000	1232.068	556.138	1234.603	556.191	1237.152	556.248	1239.697	556.308	1242.245	556.372	1244.795	556.438	1247.348	556.508	1249.903	556.580	1252.460	556.656	1255.020	556.736	1257.583	556.819	1260.147	556.904	1262.714	556.993	1000	
900	1112.928	500.612	1115.473	500.671	1118.021	500.734	1120.571	500.801	1123.124	500.871	1125.679	500.945	1128.238	501.022	1130.799	501.103	1133.363	501.188	1135.929	501.276	1138.498	501.368	1141.070	501.463	1143.644	501.562	900	
800	993.796	445.097	996.346	445.164	998.900	445.235	1001.456	445.310	1004.016	445.389	1006.579	445.472	1009.144	445.559	1011.713	445.650	1014.284	445.745	1016.859	445.844	1019.436	445.948	1022.017	446.055	1024.600	446.166	800	
700	874.676	389.599	877.234	389.675	879.795	389.756	882.359	389.842	884.927	389.932	887.499	390.027	890.073	390.126	892.652	390.231	895.233	390.339	897.818	390.453	900.406	390.571	902.998	390.693	905.593	390.821	700	
600	755.525	334.125	758.142	334.214	760.713	334.309	763.288	334.409	765.867	334.514	768.450	334.623	771.037	334.741	773.628	334.862	776.223	334.989	778.822	335.121	781.424	335.259	784.031	335.402	786.641	335.550	600	
500	636.503	278.691	639.083	278.798	641.668	278.911	644.258	279.031	646.852	279.157	649.451	279.291	652.055	279.429	654.664	279.575	657.277	279.728	659.895	279.886	662.517	280.051	665.144	280.223	667.776	280.401	500	
400	517.482	223.326	520.082	223.459	522.687	223.601	525.299	223.751	527.916	223.909	530.539	224.075	533.167	224.249	535.802	224.431	538.442	224.621	541.088	224.819	543.740	225.025	546.397	225.240	549.060	225.462	400	
360	469.897	201.212	472.507	201.360	475.124	201.518	477.747	201.684	480.377	201.860	483.013	202.044	485.656	202.238	488.305	202.439	490.960	202.651	493.621	202.871	496.289	203.100	498.962	203.338	501.643	203.585	360	100 (P)*
350	458.003	195.688	460.617	195.840	463.237	196.002	465.864	196.173	468.497	196.354	471.137	196.543	473.783	196.742	476.436	196.950	479.095	197.167	481.761	197.394	484.434	197.629	487.112	197.874	489.797	198.128	350	
300	398.561	168.099	401.192	168.217	403.832	168.466	406.479	168.666	409.133	168.875	411.795	169.096	414.465	169.328	417.142	169.571	419.826	169.824	422.518	170.088	425.217	170.362	427.923	170.648	430.637	170.944	300	
250	339.174	140.589	341.831	140.802	344.497	141.029	347.171	141.268	349.855	141.520	352.547	141.785	355.249	142.063	357.959	142.354	360.677	142.657	363.405	142.973	366.141	143.302	368.885	143.644	371.638	143.999	250	
230	315.443	129.618	318.113	129.850	320.792	130.096	323.481	130.356	326.180	130.630	328.888	130.918	331.605	131.219	334.332	131.535	337.069	131.865	339.814	132.208	342.569	132.566	345.332	132.937	348.105	133.322	230	80 (P)*
200	279.884	113.216	282.578	113.482	285.282	113.765	287.998	114.064	290.723	114.378	293.461	114.709	296.208	115.056	298.966	115.418	301.735	115.797	304.513	116.191	307.302	116.602	310.102	117.028	312.911	117.469	200	
170	244.390	96.908	247.115	97.222	249.853	97.554	252.603	97.905	255.366	98.274	258.141	98.663	260.928	99.070	263.727	99.495	266.537	99.939	269.359	100.402	272.193	100.884	275.038	101.383	277.895	101.901	170	
155	226.678	88.807	229.424	89.151	232.183	89.514	234.955	89.899	237.740	90.304	240.539	90.729	243.351	91.175	246.175	91.641	249.012	92.127	251.861	92.634	254.723	93.161	257.596	93.707	260.482	94.274	155	65 (P)*
125	191.366	72.772	194.164	73.197	196.978	73.646	199.808	74.121	202.653	74.622	205.514	75.147	208.390	75.697	211.280	76.272	214.185	76.872	217.104	77.496	220.037	78.145	222.983	78.819	225.943	79.516	125	
100	162.123	59.697	164.985	60.226	167.866	60.785	170.766	61.376	173.683	61.997	176.618	62.649	179.569	63.332	182.537	64.044	185.522	64.788	188.522	65.561	191.537	66.363	194.567	67.196	197.611	68.057	100	
90	150.502	54.592	153.398	55.178	156.315	55.797	159.250	56.451	162.205	57.139	165.177	57.860	168.168	58.615	171.175	59.403	174.200	60.223	177.240	61.077	180.296	61.963	183.367	62.881	186.453	63.831	90	50 (P)
80	138.946	49.598	141.883	50.253	144.841	50.947	147.819	51.679	150.817	52.448	153.834	53.255	156.870	54.098	159.923	54.978	162.993	55.894	166.080	56.846	169.182	57.833	172.299	58.855	175.430	59.912	80	50 (H)**
70	127.479	44.759	130.464	45.504	133.472	46.292	136.501	47.122	139.550	47.994	142.619	48.907	145.707	49.862	148.812	50.856	151.934	51.891	155.072	52.965	158.225	54.077	161.391	55.228	164.571	56.416	70	
60	116.133	40.149	119.178	41.011	122.245	41.921	125.334	42.878	128.444	43.883	131.572	44.934	134.719	46.030	137.882	47.172	141.061	48.357	144.253	49.585	147.458	50.855	150.675	52.167	153.902	53.518	60	40 (P)*
55	110.522	37.967	113.600	38.901	116.701	39.88.	119.824	40.923	122.967	42.009	126.128	43.144	129.306	44.327	132.499	45.557	135.705	46.833	138.924	48.154	142.154	49.518	145.391	50.925	148.639	52.373	55	
50	104.962	35.896	108.077	36.915	111.215	37.989	114.374	39.117	117.550	40.297	120.744	41.530	123.953	42.812	127.175	44.144	130.408	45.524	133.650	46.949	136.899	48.420	140.154	49.934	143.413	51.490	50	40 (H)**
45	99.464	33.971	102.619	35.090	105.795	36.267	108.990	37.503	112.201	38.794	115.426	40.139	118.663	41.536	121.909	42.985	125.162	44.482	128.420	46.026	131.680	47.616	134.941	49.248	138.199	50.922	45	35 (P)*
40	94.040	32.238	97.236	33.476	100.450	34.778	103.679	36.139	106.920	37.559	110.170	39.035	113.427	40.565	116.697	42.146	119.947	43.776	123.205	45.453							40	30 (H)**
35	88.700	30.766	91.933	32.148	95.179	33.597	98.434	35.108	101.693	36.678	104.954	38.304															35	
33	86.587	30.271	89.833	31.719	93.088	33.234	96.348	34.811	99.608	36.447																	33	30 (P)*
30	83.441	29.555	86.700	31.210	89.960	32.832																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 101 Degrees

Δ=101°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	3040.244	1430.346	3042.747	1430.341	3045.252	1430.347	3047.757	1430.354	3050.264	1430.363	3052.771	1430.372	3055.280	1430.383	3057.790	1430.396	3060.301	1430.410	3062.812	1430.425	3065.324	1430.441	3067.838	1430.459	3070.353	1430.478	2500	
2200	2676.315	1258.697	2678.820	1258.703	2681.325	1258.709	2683.831	1258.718	2686.339	1258.727	2688.847	1258.738	2691.357	1258.751	2693.868	1258.765	2696.380	1258.781	2698.893	1258.798	2701.407	1258.817	2703.923	1258.836	2706.439	1258.858	2200	
2000	2433.697	1144.271	2436.201	1144.277	2438.707	1144.285	2441.214	1144.294	2443.722	1144.304	2446.232	1144.317	2448.743	1144.331	2451.254	1144.346	2453.768	1144.363	2456.282	1144.382	2458.798	1144.403	2461.315	1144.425	2463.833	1144.448	2000	
1800	2191.078	1029.846	2193.583	1029.852	2196.090	1029.860	2198.597	1029.870	2201.106	1029.882	2203.617	1029.896	2206.129	1029.911	2208.642	1029.929	2211.157	1029.948	2213.673	1029.969	2216.191	1029.992	2218.709	1030.016	2221.229	1030.042	1800	
1600	1827.151	858.208	1829.657	858.216	1832.165	858.225	1834.674	858.237	1837.185	858.251	1839.698	858.268	1842.211	858.286	1844.727	858.307	1847.245	858.330	1849.764	858.355	1852.285	858.383	1854.808	858.412	1857.332	858.444	1600	
1400	1463.224	686.571	1465.732	686.580	1468.241	686.593	1470.753	686.608	1473.266	686.625	1475.782	686.644	1478.300	686.669	1480.820	686.695	1483.342	686.724	1485.866	686.755	1488.392	686.789	1490.920	686.826	1493.450	686.865	1400	
1200	1220.607	572.147	1223.116	572.158	1225.627	572.173	1228.141	572.191	1230.657	572.212	1233.176	572.237	1235.698	572.265	1238.222	572.296	1240.748	572.330	1243.277	572.368	1245.808	572.409	1248.342	572.453	1250.878	572.500	1200	
1000	1099.299	514.535	1101.809	514.948	1104.321	514.965	1106.836	514.985	1109.354	515.008	1111.875	515.035	1114.399	515.066	1116.926	515.101	1119.455	515.139	1121.987	515.181	1124.522	515.226	1127.060	515.275	1129.600	515.328	1000	
900	977.991	457.724	980.502	457.738	983.016	457.757	985.533	457.779	988.053	457.806	990.577	457.837	993.104	457.872	995.634	457.910	998.167	457.953	1000.703	458.000	1003.242	458.052	1005.784	458.107	1008.329	458.166	900	
800	856.683	400.514	859.196	400.530	861.712	400.551	864.232	400.576	866.755	400.607	869.282	400.642	871.812	400.682	874.346	400.726	876.884	400.775	879.425	400.830	881.969	400.888	884.518	400.951	887.069	401.019	800	100 (P)*
700	735.376	343.304	737.891	343.323	740.410	343.348	742.933	343.377	745.460	343.413	747.991	343.454	750.527	343.500	753.066	343.552	755.610	343.609	758.158	343.672	760.710	343.741	763.266	343.814	765.826	343.893	700	
600	614.071	286.096	616.588	286.119	619.111	286.148	621.638	286.184	624.171	286.227	626.708	286.276	629.251	286.331	631.798	286.394	634.351	286.462	636.908	286.538	639.470	286.620	642.037	286.708	644.609	286.803	600	
500	492.767	228.890	495.289	228.918	497.817	228.955	500.351	229.000	502.892	229.053	505.439	229.115	507.992	229.185	510.551	229.262	513.116	229.348	515.688	229.442	518.265	229.544	520.848	229.655	523.438	229.774	500	
450	444.246	206.009	446.771	206.041	449.302	206.081	451.840	206.131	454.385	206.191	456.937	206.259	459.496	206.336	462.062	206.422	464.634	206.518	467.213	206.622	469.799	206.736	472.391	206.859	474.990	206.991	450	
400	432.116	200.389	434.641	200.321	437.173	200.363	439.712	200.415	442.259	200.473	444.812	200.546	447.373	200.625	449.940	200.714	452.515	200.812	455.096	200.920	457.684	201.037	460.279	201.163	462.881	201.299	400	
360	371.466	171.689	373.996	171.727	376.533	171.776	379.079	171.836	381.633	171.907	384.195	171.989	386.766	172.082	389.344	172.186	391.930	172.300	394.525	172.425	397.128	172.562	399.738	172.709	402.356	172.867	360	80 (P)*
320	310.819	143.892	313.354	143.938	315.899	143.997	318.454	143.269	321.019	143.354	323.593	143.452	326.177	143.563	328.771	143.688	331.374	143.825	333.987	143.978	336.609	144.139	339.241	144.316	341.882	144.506	320	
280	286.561	131.659	289.099	131.704	291.648	131.768	294.208	131.847	296.778	131.939	299.358	132.046	301.950	132.167	304.552	132.302	307.163	132.451	309.786	132.615	312.418	132.793	315.061	132.985	317.714	133.191	280	
250	250.176	114.900	252.719	114.557	255.275	114.631	257.844	114.721	260.424	114.828	263.017	114.950	265.621	115.089	268.238	115.245	270.866	115.417	273.506	115.604	276.157	115.809	278.821	116.030	281.495	116.266	250	
220	213.793	97.349	216.344	97.417	218.910	97.503	221.490	97.609	224.084	97.734	226.693	97.879	229.315	98.042	231.951	98.225	234.601	98.427	237.264	98.648	239.941	98.888	242.632	99.148	245.335	99.426	220	65 (P)*
195	195.603	88.776	198.159	88.850	200.731	88.945	203.319	89.061	205.922	89.198	208.540	89.356	211.174	89.536	213.823	89.736	216.486	89.957	219.165	90.200	221.858	90.463	224.565	90.748	227.287	91.053	195	
175	159.227	71.624	161.797	71.726	164.385	71.844	166.993	71.988	169.621	72.158	172.266	72.354	174.931	72.576	177.613	72.825	180.314	73.099	183.032	73.399	185.768	73.725	188.522	74.077	191.292	74.455	175	
160	128.922	57.361	131.508	57.475	134.119	57.622	136.753	57.802	139.410	58.015	142.090	58.260	144.793	58.537	147.518	58.847	150.265	59.189	153.034	59.564	155.823	59.970	158.633	60.409	161.463	60.879	160	
150	116.803	51.636	119.392	51.783	122.021	51.946	124.670	52.146	127.344	52.382	130.043	52.654	132.767	52.962	135.515	53.306	138.286	53.686	141.082	54.102	143.900	54.553	146.740	55.039	149.602	55.561	150	50 (P)*
140	104.688	45.955	107.295	46.098	109.932	46.282	112.598	46.507	115.292	46.772	118.015	47.078	120.764	47.424	123.541	47.810	126.343	48.237	129.171	48.704	132.023	49.210	134.900	49.755	137.801	50.340	140	50 (H)**
130	92.576	40.260	95.199	40.423	97.854	40.633	100.542	40.890	103.263	41.193	106.014	41.542	108.796	41.937	111.608	42.378	114.448	42.864	117.316	43.396	120.212	43.973	123.134	44.594	126.081	45.259	130	
120	80.471	34.573	83.113	34.764	85.793	35.009	88.511	35.308	91.265	35.661	94.054	36.068	96.878	36.528	99.735	37.040	102.624	37.606	105.543	38.223	108.493	38.893	111.471	39.613	114.476	40.384	120	
110	74.422	31.735	77.076	31.943	79.772	32.210	82.508	32.536	85.283	32.921	88.096	33.364	90.945	33.865	93.830	34.423	96.748	35.038	99.699	35.710	102.680	36.437	105.692	37.220	108.731	38.057	110	
100	68.376	28.901	71.045	29.130	73.739	29.424	76.517	29.782	79.317	30.204	82.157	30.691	85.036	31.240	87.953	31.853	90.905	32.527	93.891	33.263	96.910	34.059	99.959	34.915	103.036	35.830	100	40 (H)**
90	62.335	26.073	65.021	26.327	67.737	26.653	70.541	27.051	73.370	27.520	76.243	28.059	79.157	28.668	82.112	29.345	85.103	30.091	88.130	30.904	91.191	31.783	94.282	32.727	97.402	33.734	90	35 (P)*
80	56.299	23.253	59.007	23.539	61.770	23.905	64.585	24.352	67.450	24.878	70.362	25.482	73.319	26.164	76.317	26.923	79.355	27.756	82.429	28.664	85.536	29.643	88.675	30.694	91.841	31.813	80	35 (H) 30 (P)*
70	50.271	20.445	53.007	20.771	55.804	21.193	58.658	21.698	61.567	22.297	64.527	22.984	67.534	23.759	70.584	24.619	73.676	25.563	76.803	26.588*	79.963	27.693	83.153	28.875	86.367	30.131	70	
65	47.863	19.326	50.612	19.672	53.425	20.115	56.298	20.654	59.227	21.288	62.209	22.015	65.239	22.834	68.313	23.742	71.428	24.738	74.579	25.819	77.761	26.982	80.971	28.225	84.204	29.545	65	
60	44.256	17.654	47.027	18.034	49.867	18.520	52.772	19.112	55.735	19.807	58.754	20.603	61.822	21.498	64.934	22.489	68.087	23.574	71.274	24.750	74.490	26.012	77.729	27.358	80.988	28.783	60	30 (H)**
55	38.258	14.891	41.078	15.345	43.976	15.926	46.946	16.631	49.979	17.457	53.070	18.401	56.211	19.458	59.395	20.625	62.613	21.896	65.859	23.266	69.125	24.724	72.403	26.280	75.685	27.913	55	
50	35.867	13.797	38.712	14.291	41.638	14.920	44.639	15.684	47.706	16.577	50.830	17.595	54.003	18.733	57.216	19.986	60.460	21.348	63.726	22.811	67.004	24.369	70.287	26.015			50	25 (P)*
45	32.293	12.176	35.181	12.741	38.159	13.461	41.214	14.332	44.337	15.347	47.516	16.500	50.738	17.783	53.992	19.189	57.266	20.708	60.548	22.330							45	25 (H)**
40	28.386	9.556	29.377	10.307	32.467	11.245	35.637	12.375	38.865	13.679	42.130	15.142	45.411	16.748													40	20 (P)*
35	25.216	9.052	28.234	9.848	31.357	10.852	34.547	12.052	37.794	13.432	41.071	14.974															35	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 101 Degrees

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=101°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	3072.868	1430.498	3075.385	1430.520	3077.902	1430.542	3080.421	1430.567	3082.941	1430.593	3085.461	1430.619	3087.983	1430.647	3090.506	1430.677	3093.029	1430.708	3095.544	1430.740	3098.080	1430.773	3100.606	1430.808	3103.134	1430.844	2500	
2200	2708.957	1258.881	2711.476	1258.906	2713.996	1258.932	2716.517	1258.959	2719.040	1258.989	2721.563	1259.019	2724.087	1259.051	2726.613	1259.084	2729.140	1259.119	2731.668	1259.156	2734.197	1259.194	2736.727	1259.233	2739.258	1259.274	2200	
2000	2467.353	1144.474	2468.873	1144.501	2471.395	1144.530	2473.918	1144.560	2476.443	1144.592	2478.969	1144.625	2481.496	1144.661	2484.024	1144.697	2486.554	1144.736	2489.084	1144.776	2491.616	1144.818	2494.149	1144.861	2496.684	1144.906	2000	
1800	2223.751	1030.071	2226.274	1030.101	2228.799	1030.133	2231.325	1030.166	2233.852	1030.202	2236.380	1030.239	2238.910	1030.278	2241.442	1030.319	2243.974	1030.362	2246.508	1030.406	2249.044	1030.453	2251.581	1030.501	2254.119	1030.551	1800	
1500	1859.858	858.478	1865.386	858.514	1864.915	858.552	1867.446	858.592	1869.979	858.635	1872.513	858.679	1875.049	858.727	1877.586	858.776	1880.125	858.827	1882.667	858.881	1885.209	858.936	1887.753	858.994	1890.299	859.054	1500	
1200	1495.983	686.908	1498.518	686.953	1501.054	687.001	1503.592	687.051	1506.133	687.104	1508.676	687.160	1511.221	687.219	1513.768	687.281	1516.316	687.344	1518.867	687.411	1521.420	687.481	1523.975	687.553	1526.532	687.628	1200	
1000	1253.417	572.551	1255.958	572.605	1258.502	572.663	1261.048	572.723	1263.597	572.787	1266.148	572.854	1268.702	572.925	1271.258	572.998	1273.816	573.075	1276.377	573.155	1278.941	573.239	1281.507	573.326	1284.074	573.416	1000	
900	1132.143	515.385	1134.689	515.445	1137.237	515.509	1139.788	515.576	1142.343	515.647	1144.899	515.721	1147.459	515.799	1150.021	515.881	1152.586	615.967	1155.153	516.056	1157.724	516.149	1160.297	516.245	1162.873	516.345	900	
800	1010.877	458.229	1013.429	458.297	1015.984	458.369	1018.541	458.445	1021.102	458.524	1023.666	458.608	1026.232	458.696	1028.802	458.788	1031.375	458.885	1033.951	458.985	1036.530	459.089	1039.112	459.198	1041.697	459.310	800	
700	889.625	401.091	892.183	401.168	894.746	401.250	897.311	401.337	899.880	401.428	902.453	401.524	905.029	401.624	907.609	401.730	910.192	401.840	912.778	401.954	915.368	402.073	917.961	402.198	920.558	402.326	700	
600	768.391	343.978	770.959	344.068	773.531	344.164	776.108	344.265	778.688	344.371	781.272	344.483	783.861	344.600	786.454	344.723	789.050	344.851	791.651	344.985	794.255	345.124	796.864	345.268	799.476	345.418	600	
500	647.186	286.904	649.768	287.012	652.354	287.127	654.956	287.248	657.542	287.376	660.143	287.510	662.748	287.650	665.359	287.798	667.974	287.952	670.594	288.112	673.219	288.279	675.848	288.452	678.482	288.632	500	
400	526.033	229.901	528.635	230.035	531.242	230.178	533.856	230.330	536.475	230.490	539.101	230.657	541.731	230.833	544.369	231.017	547.011	231.209	549.660	231.409	552.315	231.618	554.975	231.834	557.641	232.059	400	
360	477.596	207.132	480.208	207.281	482.828	207.441	485.453	207.609	488.085	207.786	490.724	207.972	493.369	208.168	496.021	208.372	498.679	208.585	501.343	208.807	504.014	209.039	506.691	209.280	509.375	209.529	360	100 (P)*
350	465.490	201.443	468.105	201.598	470.728	201.761	473.357	201.934	475.993	202.117	478.635	202.308	481.284	202.509	483.940	202.719	486.602	202.938	489.271	203.167	491.947	203.406	494.628	203.653	497.317	203.909	350	
300	404.983	173.036	407.617	173.216	410.259	173.407	412.908	173.609	415.566	173.821	418.231	174.044	420.903	164.278	423.584	174.524	426.271	174.779	428.967	175.046	431.670	175.323	434.380	175.612	437.098	175.911	300	
250	344.532	144.708	347.192	144.924	349.861	145.153	352.539	145.395	355.226	145.649	357.922	145.917	360.627	146.198	363.341	146.492	366.064	146.798	368.796	147.118	371.536	147.450	374.286	147.796	377.043	148.154	250	
230	320.377	133.411	323.050	133.646	325.732	133.894	328.425	134.157	331.127	134.434	333.839	134.725	336.561	135.030	339.292	135.349	342.033	135.682	344.783	136.029	347.543	136.390	350.312	136.765	353.090	137.154	230	80 (P)*
200	284.181	116.520	286.878	116.789	289.587	117.075	292.306	117.376	295.037	117.694	297.778	118.029	300.531	118.379	303.293	118.745	306.067	119.128	308.851	119.526	311.646	119.941	314.451	120.371	317.266	120.818	200	
170	248.052	99.724	250.781	100.040	253.524	100.376	256.279	100.730	259.047	101.104	261.827	101.496	264.619	101.907	267.424	102.338	270.240	102.787	273.069	103.254	275.909	103.740	278.761	104.246	281.625	104.769	170	
155	230.023	91.379	232.773	91.726	235.537	92.093	238.315	92.482	241.106	91.891	243.910	93.321	246.728	93.771	249.559	94.242	252.402	94.734	255.258	95.246	258.127	95.778	261.009	96.331	263.902	96.904	155	65 (P)*
125	194.079	74.858	196.883	75.287	199.703	75.742	202.540	76.222	205.392	76.727	208.260	77.258	211.143	77.814	214.041	78.395	216.954	79.001	219.882	79.632	222.824	80.288	225.779	80.968	228.749	81.674	125	
100	164.314	61.382	167.183	61.916	170.072	62.481	172.980	63.078	175.905	63.706	178.849	64.365	181.810	65.054	184.788	65.775	187.782	66.528	190.793	67.307	193.819	68.118	196.861	68.959	199.917	69.830	100	
90	152.486	56.117	155.390	56.709	158.315	57.335	161.259	57.996	164.223	58.691	167.206	59.420	170.207	60.182	173.225	60.978	176.261	61.808	179.313	62.670	182.381	63.566	185.465	64.493	188.563	65.453	90	50 (P)
80	140.724	50.964	143.670	51.627	146.637	52.329	149.626	53.068	152.634	53.845	155.663	54.660	158.710	55.513	161.775	56.402	164.858	57.327	167.957	58.289	171.073	59.287	174.204	60.320	177.349	61.388	80	50 (H)**
70	129.053	45.969	132.049	46.722	135.067	47.518	138.108	48.357	141.169	49.239	144.250	50.162	147.351	51.126	150.470	52.131	153.606	53.177	156.759	54.262	159.927	55.386	163.109	56.549	166.305	57.749	70	
60	117.507	41.205	120.563	42.076	123.643	42.996	126.745	43.963	129.869	44.979	133.012	46.041	136.174	47.149	139.352	48.302	142.547	49.500	145.757	50.741	148.979	52.024	152.214	53.350	155.459	54.716	60	40 (P)*
55	111.797	38.947	114.888	39.891	118.003	40.887	121.140	41.934	124.298	43.032	127.474	44.179	130.668	45.375	133.878	46.618	137.103	47.907	140.340	49.242	143.588	50.620	146.846	52.042	150.112	53.506	55	
50	106.140	36.802	109.270	37.832	112.422	38.917	115.596	40.056	118.789	41.250	122.000	42.495	125.226	43.791	128.466	45.137	131.718	46.531	134.980	47.972	138.250	49.458	141.525	50.988	144.806	52.560	50	40 (H)**
45	100.548	34.804	103.718	35.934	106.910	37.125	110.122	38.373	113.351	39.677	116.594	41.037	119.850	42.449	123.116	43.913	126.390	45.426	129.669	46.986	132.951	48.593	136.234	50.243	139.515	51.934	45	35 (P)*
40	95.031	33.000	98.244	34.251	101.476	35.566	104.723	36.942	107.984	38.377	111.254	39.869	114.532	41.415	117.814	43.013	121.097	44.660	124.378	46.354							40	30 (H)**
35	89.602	31.459	92.854	32.857	96.120	34.320	99.396	35.847	102.677	37.434	105.960	39.078															35	
33	87.455	30.938	90.721	32.402	93.997	33.932	97.278	35.526	100.561	37.180																	33	30 (P)
30	84.260	30.284	87.540	31.856	90.822	33.495																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 102 Degrees

$\Delta = 102°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3094.341	1472.541	3097.245	1472.546	3099.750	1472.552	3102.255	1472.559	3104.762	1472.568	3107.270	1472.577	3109.779	1472.589	3112.288	1472.602	3114.799	1472.615	3117.311	1472.631	3119.823	1472.647	3122.338	1472.665	3124.852	1472.684	2500	
2200	2724.774	1295.837	2726.778	1295.843	2729.283	1295.850	2731.790	1295.858	2734.297	1295.868	2736.806	1295.879	2739.316	1295.892	2741.827	1295.906	2744.339	1295.922	2746.852	1295.939	2749.367	1295.958	2751.883	1295.978	2754.400	1296.000	2200	
2000	2477.295	1178.035	2479.800	1178.041	2482.305	1178.049	2484.813	1178.058	2487.321	1178.069	2489.831	1178.081	2492.342	1178.095	2494.854	1178.111	2497.367	1178.128	2499.882	1178.147	2502.398	1178.168	2504.915	1178.190	2507.434	1178.214	2000	
1800	2230.317	1060.233	2232.822	1060.240	2235.328	1060.248	2237.836	1060.258	2240.345	1060.270	2242.856	1060.284	2245.368	1060.300	2247.882	1060.317	2250.397	1060.337	2252.913	1060.358	2255.431	1060.381	2257.950	1060.406	2260.471	1060.432	1800	
1600	1859.850	883.531	1862.356	883.539	1864.864	883.549	1867.373	883.561	1869.884	883.575	1872.397	883.592	1874.911	883.610	1877.427	883.631	1879.946	883.655	1882.465	883.680	1884.987	883.708	1887.510	883.738	1890.034	883.769	1800	
1200	1489.383	706.829	1491.891	706.839	1494.401	706.851	1496.912	706.866	1499.426	706.884	1501.942	706.905	1504.460	706.929	1506.981	706.955	1509.503	706.984	1512.027	707.015	1514.554	707.050	1517.083	707.087	1519.614	707.127	1200	
1000	1242.406	589.029	1244.913	589.041	1247.427	589.056	1249.941	589.074	1252.458	589.095	1254.977	589.120	1257.499	589.148	1260.023	589.180	1262.550	589.214	1265.079	589.252	1267.611	589.294	1270.145	589.338	1272.682	589.386	1000	
900	1118.918	530.129	1121.428	530.142	1123.941	530.159	1126.457	530.179	1128.975	530.203	1131.496	530.230	1134.021	530.262	1136.547	530.297	1139.078	530.335	1141.610	530.378	1144.145	530.423	1146.684	530.473	1149.225	530.527	900	
800	995.430	471.230	997.941	471.244	1000.456	471.263	1002.973	471.286	1005.494	471.313	1008.018	471.344	1010.546	471.379	1013.076	471.418	1015.609	471.461	1018.146	471.509	1020.686	471.561	1023.229	471.617	1025.775	471.677	800	
700	871.943	412.331	874.456	412.348	876.972	412.369	879.492	412.395	882.016	412.426	884.543	412.461	887.074	412.501	889.609	412.546	892.147	412.596	894.689	412.650	897.234	412.709	899.784	412.773	902.336	412.842	700	100 (P)*
600	748.456	353.433	750.971	353.453	753.490	353.478	756.014	353.508	758.541	353.543	761.073	353.585	763.610	353.632	766.150	353.684	768.694	353.742	771.243	353.806	773.796	353.875	776.353	353.949	778.914	354.029	600	
500	624.971	294.537	627.489	294.560	630.011	294.590	632.540	294.626	635.073	294.669	637.611	294.719	640.154	294.775	642.702	294.838	645.256	294.907	647.814	294.984	650.377	295.066	652.946	295.156	655.519	295.252	500	
400	501.487	235.643	504.009	235.672	506.538	235.709	509.073	235.755	511.614	235.809	514.162	235.871	516.716	235.941	519.276	236.020	521.843	236.106	524.415	236.201	526.994	236.305	529.579	236.417	532.170	236.536	400	
360	452.094	212.087	454.619	212.119	457.151	212.160	459.690	212.211	462.236	212.271	464.789	212.339	467.349	212.417	469.916	212.505	472.489	212.601	475.070	212.707	477.657	212.822	480.251	212.946	482.852	213.079	360	
350	439.746	206.198	442.272	206.230	444.805	206.273	447.344	206.325	449.892	206.386	452.446	206.458	455.008	206.538	457.576	206.628	460.152	206.727	462.735	206.836	465.325	206.954	467.921	207.081	470.525	207.219	350	
300	378.007	176.734	380.537	176.793	383.075	176.862	385.622	176.903	388.177	176.975	390.740	177.057	393.312	177.151	395.891	177.256	398.479	177.372	401.076	177.498	403.680	177.636	406.292	177.785	408.913	177.945	300	80 (P)*
250	316.270	147.313	318.805	147.359	321.351	147.419	323.907	147.492	326.473	147.578	329.049	147.677	331.634	147.790	334.230	147.915	336.835	148.054	339.450	148.207	342.074	148.372	344.708	148.550	347.352	148.742	250	
230	291.576	135.538	294.115	135.588	296.664	135.653	299.225	135.732	301.796	133.826	304.378	135.934	306.972	136.056	309.575	136.193	312.189	136.344	314.813	136.509	317.448	136.688	320.094	136.883	322.750	137.091	230	
200	254.536	117.877	257.081	117.935	259.638	118.010	262.208	118.101	264.790	118.208	267.384	118.332	269.990	118.473	272.609	118.630	275.239	118.803	277.882	118.994	280.536	119.200	283.202	119.423	285.880	119.663	200	
170	217.500	100.220	220.052	100.288	222.619	100.376	225.201	100.483	227.797	100.609	230.407	100.755	233.031	100.921	235.670	101.103	238.323	101.309	240.989	101.533	243.670	101.776	246.364	102.038	249.071	102.319	170	65 (P)*
155	198.983	91.393	201.540	91.468	204.113	91.564	206.703	91.681	209.308	91.820	211.928	91.980	214.565	92.162	217.216	92.364	219.883	92.588	222.563	92.833	225.261	93.099	227.973	93.386	230.699	93.695	155	
125	161.954	73.746	164.524	73.839	167.115	73.958	169.725	74.103	172.354	74.275	175.003	74.473	177.670	74.698	180.356	74.949	183.061	75.226	185.783	75.530	188.524	75.859	191.282	76.215	194.058	76.597	125	
100	131.104	59.050	133.692	59.166	136.304	59.315	138.941	59.497	141.601	59.712	144.285	59.959	146.992	60.240	149.721	60.553	152.473	60.899	155.246	61.277	158.041	61.688	160.857	62.131	163.694	62.607	100	
90	118.767	53.177	121.365	53.305	123.990	53.471	126.641	53.673	129.318	53.911	132.021	54.186	134.749	54.498	137.502	54.845	140.279	55.229	143.080	55.649	145.904	56.105	148.751	56.597	151.621	57.124	90	50 (P)*
80	106.434	47.307	109.044	47.452	111.683	47.638	114.352	47.865	117.050	48.133	119.777	48.442	122.531	48.792	125.313	49.183	128.121	49.614	130.955	50.086	133.815	50.597	136.700	51.149	139.608	51.740	80	50 (H)**
70	94.105	41.444	96.750	41.602	99.388	41.821	102.080	42.081	104.805	42.387	107.561	42.740	110.348	43.139	113.166	43.585	116.013	44.076	118.889	44.614	121.792	45.197	124.723	45.824	127.679	46.497	70	
60	81.783	35.589	84.427	35.782	87.111	36.029	89.833	36.332	92.592	36.689	95.387	37.099	98.217	37.564	101.080	38.083	103.977	38.654	106.905	39.278	109.864	39.954	112.852	40.683	115.868	41.462	60	40 (P)*
55	75.625	32.666	78.282	32.877	80.981	33.147	83.722	33.476	86.502	33.865	89.321	34.313	92.177	34.819	95.070	35.383	97.996	36.005	100.956	36.684	103.948	37.419	106.970	38.210	110.021	39.056	55	
50	69.470	29.748	72.142	29.980	74.860	30.276	77.623	30.639	80.429	31.066	83.276	31.557	86.163	32.113	89.088	32.732	92.049	33.413	95.046	34.157	98.075	34.962	101.136	35.827	104.226	36.751	50	40 (H)**
45	63.320	26.836	66.010	27.093	68.731	27.423	71.540	27.825	74.376	28.298	77.256	28.843	80.179	29.459	83.143	30.144	86.145	30.897	89.183	31.719	92.255	32.607	95.359	33.561	98.493	34.576	45	35 (P)*
40	57.176	23.933	59.888	24.221	62.656	24.591	65.478	25.043	68.350	25.574	71.270	26.185	74.236	26.875	77.245	27.641	80.294	28.484	83.381	29.401	86.502	30.393	89.655	31.453	92.836	32.584	40	35 (H) 30 (P)*
35	51.040	21.040	53.781	21.370	56.583	21.792	59.444	22.307	62.361	22.912	65.331	23.607	68.348	24.390	71.411	25.259	74.515	26.213	77.657	27.250	80.833	28.366	84.038	29.541	87.270	30.830	35	
30	44.916	18.166	47.693	18.550	50.540	19.041	53.453	19.639	56.426	20.341	59.455	21.146	62.536	22.051	65.662	23.053	68.830	24.150	72.033	25.338	75.266	26.614	78.525	27.974	81.803	29.414	30	30 (H)**
25	38.812	15.319	41.638	15.779	44.544	16.366	47.523	17.078	50.568	17.913	53.672	18.867	56.828	19.936	60.027	21.115	63.263	22.399	66.528	23.784	69.814	25.263	73.114	26.831	76.419	28.481	25	
23	36.378	14.193	39.229	14.691	42.164	15.328	45.176	16.099	48.255	17.002	51.393	18.031	54.582	19.181	57.812	20.448	61.075	21.824	64.361	23.303	67.661	24.878	70.967	26.542			23	25 (P)*
20	32.739	12.521	35.635	13.093	38.623	13.821	41.690	14.701	44.827	15.726	48.022	16.892	51.262	18.189	54.535	19.610	57.830	21.145	61.135	22.785							20	25 (H)**
15	26.726	9.820	29.728	10.373	32.831	11.526	36.016	12.669	39.262	13.987	42.548	15.466	45.851	17.088													15	20 (P)*
14	25.536	9.299	28.564	10.104	31.666	11.119	34.908	12.332	38.175	13.727	41.472	15.285															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 102 Degrees

$\Delta = 102°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	3127.368	1472.705	3129.885	1472.726	3132.403	1472.750	3134.922	1472.774	3137.442	1472.800	3139.963	1472.827	3142.485	1472.855	3145.008	1472.885	3147.532	1472.917	3150.057	1472.949	3152.583	1472.983	3155.110	1473.018	3157.639	1473.054	2500	
2200	2756.917	1296.023	2759.437	1296.048	2761.957	1296.074	2764.479	1296.103	2767.002	1296.132	2769.525	1296.163	2772.050	1296.195	2774.577	1296.229	2777.104	1296.264	2779.632	1296.301	2782.162	1296.340	2784.693	1296.379	2787.224	1296.421	2200	
2000	2509.934	1178.240	2512.473	1178.268	2514.997	1178.296	2517.521	1178.327	2520.046	1178.359	2522.572	1178.393	2525.099	1178.429	2527.628	1178.466	2530.158	1178.505	2532.689	1178.545	2535.222	1178.587	2537.756	1178.631	2540.291	1178.677	2000	
1800	2262.993	1060.461	2265.516	1060.491	2268.041	1060.523	2270.568	1060.557	2273.095	1060.593	2275.624	1060.631	2278.153	1060.670	2280.687	1060.712	2283.220	1060.755	2285.755	1060.800	2288.291	1060.847	2290.828	1060.896	2293.367	1060.946	1800	
1500	1892.561	883.803	1895.089	883.840	1897.619	883.879	1900.150	883.919	1902.683	883.963	1905.218	884.008	1907.755	884.055	1910.293	884.105	1912.833	884.156	1915.375	884.211	1917.918	884.267	1920.462	884.325	1923.009	884.386	1500	
1200	1522.146	707.170	1524.682	707.216	1527.219	707.264	1529.758	707.315	1532.300	707.368	1534.843	707.425	1537.389	707.485	1539.937	707.547	1542.486	707.611	1545.038	707.679	1547.592	707.749	1550.148	707.823	1552.706	707.898	1200	
1000	1273.222	589.438	1277.764	589.492	1280.309	589.550	1282.855	589.612	1285.405	589.676	1287.957	589.744	1290.512	589.815	1293.069	589.890	1295.628	589.967	1298.190	590.048	1300.755	590.133	1303.322	590.220	1305.891	590.311	1000	
900	1151.769	530.383	1154.315	530.644	1156.865	530.708	1159.417	530.776	1161.972	530.848	1164.530	530.923	1167.090	531.003	1169.653	531.085	1172.219	531.172	1174.788	531.262	1177.360	531.356	1179.934	531.453	1182.511	531.554	900	
800	1028.324	471.741	1030.876	471.809	1033.432	471.882	1035.990	471.958	1038.552	472.039	1041.117	472.124	1043.685	472.212	1046.256	472.306	1048.830	472.403	1051.408	472.504	1053.988	472.609	1056.572	472.719	1059.158	472.833	800	
700	904.892	412.915	907.452	412.993	910.016	413.076	912.582	413.163	915.153	413.256	917.727	413.352	920.304	413.454	922.885	413.561	925.470	413.672	928.058	413.787	930.650	413.908	933.245	414.033	935.843	414.163	700	
600	781.480	354.115	784.049	354.206	786.623	354.302	789.201	354.404	791.783	354.512	794.369	354.625	796.959	354.743	799.553	354.867	802.151	354.997	804.754	355.132	807.360	355.272	809.971	355.419	812.585	355.570	600	
500	658.097	295.354	660.680	295.463	663.269	295.579	665.862	295.702	668.459	295.831	671.062	295.967	673.670	296.108	676.282	296.257	678.900	296.413	681.522	296.575	684.149	296.743	686.781	296.919	689.417	297.102	500	
400	534.768	236.665	537.371	236.801	539.980	236.946	542.596	237.099	545.217	237.260	547.845	237.429	550.479	237.607	553.118	237.793	555.764	237.987	558.415	238.190	561.073	238.400	563.736	238.619	566.405	238.846	400	
360	485.460	213.222	488.074	213.373	490.696	213.534	493.324	213.704	495.958	213.883	498.600	214.071	501.248	214.269	503.902	214.475	506.563	214.691	509.230	214.916	511.904	215.150	514.584	215.393	517.271	215.645	360	100 (P)*
350	473.136	207.365	475.754	207.521	478.378	207.686	481.010	207.861	483.648	208.045	486.293	208.239	488.945	208.442	491.604	208.655	494.269	208.876	496.941	209.107	499.620	209.348	502.305	209.598	504.997	209.857	350	
300	411.542	178.116	414.178	178.298	416.823	178.490	419.476	178.694	422.136	178.909	424.804	179.135	427.480	179.371	430.164	179.619	432.855	179.878	435.554	180.147	438.260	180.428	440.975	180.719	443.697	181.022	300	
250	350.006	148.947	352.668	149.165	355.340	149.396	358.022	149.641	360.712	149.898	363.412	150.169	366.121	150.452	368.839	150.749	371.566	151.059	374.302	151.382	377.047	151.719	379.801	152.068	382.564	152.430	250	
230	325.416	137.313	328.092	137.551	330.778	137.802	333.474	138.067	336.181	138.347	338.896	138.641	341.623	138.949	344.358	139.272	347.104	139.608	349.859	139.959	352.623	140.324	355.397	140.703	358.180	141.097	230	80 (P)*
200	288.570	119.918	291.271	120.191	293.983	120.479	296.707	120.784	299.442	121.106	302.188	121.444	304.945	121.798	307.713	122.168	310.492	122.554	313.282	122.957	316.082	123.376	318.893	123.812	321.715	124.263	200	
170	251.792	102.620	254.326	102.840	257.273	103.279	260.033	103.637	262.806	104.015	265.591	104.412	268.389	104.827	271.200	105.262	274.023	105.716	276.858	106.188	279.705	106.680	282.564	107.190	285.435	107.720	170	
155	233.440	94.024	236.194	94.375	238.963	94.747	241.746	95.139	244.543	95.553	247.353	95.987	250.177	96.443	253.015	96.919	255.865	97.415	258.728	97.933	261.604	98.471	264.493	99.030	267.395	99.609	155	65 (P)*
125	196.851	77.004	199.660	77.438	202.487	77.897	205.330	78.382	208.189	78.893	211.064	79.430	213.955	79.992	216.862	80.579	219.783	81.192	222.719	81.829	225.670	82.492	228.635	83.180	231.615	83.893	125	
100	166.551	63.115	169.429	63.654	172.325	64.226	175.241	64.829	178.175	65.464	181.128	66.130	184.099	66.827	187.087	67.555	190.091	68.314	193.113	69.103	196.150	69.923	199.204	70.774	202.272	71.654	100	
90	154.512	57.686	157.424	58.284	160.358	58.917	163.312	59.585	166.285	60.287	169.278	61.024	172.289	61.795	175.319	62.600	178.366	63.438	181.430	64.310	184.511	65.215	187.607	66.152	190.719	67.123	90	50 (P)
80	142.540	52.371	145.495	53.041	148.472	53.750	151.471	54.497	154.490	55.283	157.530	56.106	160.589	56.968	163.666	57.867	166.762	58.802	169.875	59.774	173.004	60.783	176.149	61.827	179.310	62.906	80	30 (H)**
70	130.661	47.214	133.667	47.975	136.697	48.780	139.749	49.628	142.822	50.519	145.917	51.452	149.031	52.427	152.164	53.443	155.314	54.499	158.482	55.596	161.665	56.732	164.864	57.908	168.076	59.121	70	
60	118.910	42.292	121.979	43.172	125.071	44.102	128.187	45.080	131.324	46.106	134.482	47.179	137.659	48.299	140.854	49.465	144.065	50.675	147.292	51.930	150.532	53.227	153.785	54.567	157.050	55.948	60	40 (P)*
55	113.100	39.956	116.204	40.910	119.333	41.917	122.484	42.975	125.657	44.085	128.849	45.244	132.060	46.452	135.287	47.709	138.529	49.012	141.785	50.361	145.052	51.755	148.330	53.192	151.616	54.671	55	
50	107.344	37.734	110.488	38.775	113.635	39.872	116.845	41.023	120.055	42.229	123.283	43.488	126.527	44.798	129.786	46.159	133.057	47.568	136.338	49.024	139.629	50.526	142.926	52.072	146.228	53.661	50	40 (H)**
45	101.654	35.661	104.840	36.804	108.049	38.007	111.278	39.268	114.525	40.587	117.787	41.961	121.063	43.388	124.349	44.868	127.643	46.397	130.944	47.974	134.249	49.598	137.554	51.265	140.859	52.975	45	35 (P)*
40	96.044	33.784	99.274	35.049	102.524	36.378	105.790	37.769	109.071	39.219	112.362	40.727	115.661	42.289	118.965	43.904	122.270	45.569	125.575	47.281							40	30 (H)**
35	90.523	32.173	93.795	33.585	97.081	35.065	100.378	36.608	103.681	38.212	106.987	39.873															35	
33	88.342	31.625	91.628	33.104	94.925	34.651	98.229	36.262	101.534	37.934																	33	30 (P)*
30	85.096	30.931	88.397	32.320	91.703	34.177																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)*
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 103 Degrees **$\Delta = 103°$**

Rc	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		Rc	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	3150.431	1515.971	3152.935	1515.976	3155.440	1515.982	3157.945	1515.990	3160.452	1515.998	3162.960	1516.008	3165.469	1516.020	3167.979	1516.032	3170.490	1516.047	3173.002	1516.062	3175.515	1516.078	3178.029	1516.097	3180.544	1516.116	2500	
2200	2773.281	1334.056	2775.785	1334.062	2778.290	1334.068	2780.797	1334.077	2783.305	1334.087	2785.813	1334.098	2788.324	1334.111	2790.835	1334.126	2793.347	1334.142	2795.861	1334.159	2798.376	1334.178	2800.892	1334.199	2803.409	1334.221	2200	
2000	2521.847	1212.780	2524.352	1212.786	2526.858	1212.793	2529.365	1212.802	2531.874	1212.813	2534.383	1212.826	2536.895	1212.840	2539.407	1212.856	2541.920	1212.874	2544.435	1212.893	2546.952	1212.914	2549.469	1212.936	2551.988	1212.961	2000	
1800	2270.414	1091.503	2272.919	1091.510	2275.425	1091.518	2277.933	1091.529	2280.443	1091.541	2282.954	1891.555	2285.466	1091.570	2287.980	1091.588	2290.495	1091.608	2293.012	1091.629	2295.530	1091.652	2298.050	1091.677	2300.570	1091.704	1800	
1500	1893.264	909.589	1895.770	909.597	1898.278	909.607	1900.787	909.619	1903.299	909.634	1905.812	909.651	1908.326	909.669	1910.843	909.691	1913.361	909.714	1915.881	909.740	1918.403	909.768	1920.927	909.798	1923.452	909.830	1500	
1200	1516.115	727.676	1518.622	727.686	1521.132	727.698	1523.644	727.714	1526.158	727.732	1528.675	727.753	1531.193	727.776	1533.714	727.803	1536.236	727.832	1538.761	727.864	1541.289	727.899	1543.818	727.937	1546.349	727.977	1200	
1000	1264.682	606.401	1267.192	606.413	1269.704	606.428	1272.218	606.447	1274.735	606.468	1277.254	606.493	1279.776	606.522	1282.301	606.554	1284.828	606.589	1287.358	606.627	1289.891	606.669	1292.426	606.714	1294.964	606.763	1000	
900	1138.967	545.764	1141.477	545.777	1143.990	545.794	1146.506	545.815	1149.025	545.839	1151.546	545.865	1154.071	545.898	1156.598	545.933	1159.129	545.973	1161.662	546.015	1164.198	546.062	1166.737	546.112	1169.279	546.166	900	
800	1013.251	485.128	1015.763	485.142	1018.277	485.161	1020.795	485.184	1023.316	485.211	1025.841	485.243	1028.369	485.278	1030.899	485.318	1033.434	485.362	1035.971	485.410	1038.511	485.462	1041.055	485.519	1043.602	485.580	800	
700	887.536	424.492	890.050	424.509	892.566	424.530	895.086	424.556	897.611	424.588	900.139	424.623	902.670	424.664	905.205	424.709	907.744	424.759	910.287	424.815	912.833	424.874	915.383	424.939	917.937	425.008	700	100 (P)*
600	761.822	363.857	764.337	363.876	766.857	363.901	769.381	363.932	771.909	363.968	774.441	364.010	776.978	364.058	779.519	364.111	782.064	364.169	784.614	364.233	787.168	364.303	789.726	364.378	792.289	364.459	600	
500	636.109	303.223	638.627	303.247	641.150	303.277	643.679	303.313	646.213	303.357	648.752	303.407	651.296	303.464	653.845	303.528	656.399	303.598	658.959	303.675	661.523	303.759	664.093	303.849	666.667	303.946	500	
400	510.398	242.592	512.920	242.622	515.450	242.659	517.985	242.705	520.528	242.760	523.076	242.822	525.631	242.893	528.193	242.973	530.760	243.060	533.334	243.157	535.914	243.261	538.501	243.374	541.094	243.495	400	
360	460.114	218.341	462.639	218.374	465.172	218.415	467.711	218.467	470.258	218.527	472.812	218.596	475.373	218.676	477.941	218.764	480.516	218.861	483.098	218.968	485.687	219.084	488.283	219.210	490.886	219.344	360	
350	447.543	212.278	450.069	212.312	452.603	212.355	455.144	212.407	457.691	212.469	460.247	212.541	462.810	212.622	465.380	212.713	467.957	212.814	470.541	212.922	473.133	213.043	475.731	213.172	478.337	213.311	350	
300	384.690	181.966	387.221	182.005	389.760	182.055	392.307	182.117	394.863	182.189	397.427	182.273	400.001	182.368	402.582	182.474	405.171	182.590	407.770	182.719	410.376	182.858	412.990	183.009	415.613	183.170	300	80 (P)*
250	321.840	151.657	324.376	151.704	326.923	151.764	329.479	151.837	332.046	151.925	334.624	152.025	337.211	152.138	339.808	152.266	342.415	152.406	345.032	152.560	347.659	152.727	350.296	152.907	352.942	153.101	250	
230	296.700	139.534	299.240	139.585	301.790	139.651	304.352	139.731	306.925	139.825	309.509	139.934	312.103	140.058	314.709	140.196	317.325	140.349	319.952	140.516	322.589	140.698	325.237	140.894	327.896	141.104	230	
200	258.993	121.353	261.538	121.411	264.096	121.486	266.667	121.578	269.250	121.687	271.846	121.812	274.455	121.955	277.075	122.114	279.708	122.289	282.354	122.481	285.011	122.690	287.680	122.915	290.362	123.157	200	
170	221.288	103.174	223.841	103.243	226.409	103.332	228.992	103.440	231.590	103.568	234.203	103.715	236.829	103.883	239.471	104.069	242.126	104.276	244.796	104.503	247.480	104.747	250.177	105.012	252.888	105.296	170	65 (P)*
155	203.437	94.087	204.995	94.163	207.570	94.260	210.161	94.378	212.768	94.519	215.391	94.680	218.029	94.864	220.684	95.068	223.354	95.295	226.039	95.542	228.739	95.811	231.455	96.102	234.185	96.414	155	
125	164.740	75.919	167.312	76.012	169.904	76.133	172.516	76.280	175.148	76.454	177.799	76.654	180.470	76.881	183.159	77.135	185.867	77.415	188.594	77.722	191.339	78.055	194.103	78.415	196.884	78.801	125	
100	133.334	60.789	135.923	60.906	138.538	61.057	141.177	61.241	143.840	61.458	146.527	61.708	149.238	61.992	151.972	62.308	154.728	62.658	157.507	63.040	160.308	63.456	163.130	63.904	165.974	64.385	100	
90	120.775	54.742	123.374	54.872	126.001	55.039	128.655	55.243	131.335	55.485	134.042	55.763	136.775	56.077	139.532	56.429	142.315	56.817	145.122	57.241	149.952	57.702	150.806	58.199	153.683	58.732	90	50 (P)*
80	108.219	48.699	110.830	48.845	113.472	49.033	116.145	49.263	118.847	49.534	121.577	49.847	124.337	50.200	127.124	50.595	129.938	51.031	132.779	51.508	135.646	52.025	138.538	52.583	141.455	53.180	80	50 (H)**
70	95.667	42.662	98.294	42.829	100.956	43.044	103.651	43.306	106.380	43.616	109.141	43.972	111.934	44.376	114.758	44.827	117.612	45.328	120.496	45.867	123.407	46.456	126.346	47.091	129.312	47.771	70	
60	83.123	36.634	85.770	36.829	88.457	37.079	91.183	37.385	93.947	37.746	96.748	38.161	99.584	38.631	102.455	39.155	105.360	39.732	108.297	40.363	111.265	41.047	114.263	41.783	117.290	42.571	60	40 (P)*
55	76.854	33.625	79.514	33.837	82.217	34.110	84.962	34.444	87.748	34.837	90.573	35.289	93.437	35.801	96.337	36.371	99.272	37.000	102.242	37.689	105.249	38.439	108.277	39.229	111.340	40.084	55	
50	70.588	30.620	73.264	30.854	75.986	31.154	78.753	31.520	81.565	31.952	84.419	32.449	87.314	33.011	90.247	33.636	93.219	34.325	96.226	35.077	99.266	35.891	102.339	36.765	105.442	37.700	50	40 (H)**
45	64.337	27.622	67.021	27.881	69.766	28.214	72.561	28.621	75.403	29.100	78.291	29.650	81.225	30.273	84.196	30.965	87.209	31.727	90.258	32.558	93.343	33.465	96.461	34.450	96.609	35.449	45	35 (P)*
40	58.072	24.631	60.789	24.923	63.562	25.298	66.389	25.754	69.269	26.291	72.198	26.909	75.174	27.606	78.193	28.381	81.254	29.233	84.354	30.160	87.489	31.161	90.657	32.234	93.854	33.378	40	35 (H) 30 (P)*
35	51.826	21.633	54.571	21.986	57.379	22.413	60.248	22.933	63.173	23.545	66.152	24.248	69.181	25.039	72.256	25.918	75.373	26.885	78.530	27.930	81.724	29.059	84.943	30.266	88.193	31.550	35	
33	49.330	20.466	52.089	20.819	54.914	21.272	57.802	21.823	60.749	22.471	63.751	23.214	66.804	24.050	69.904	24.979	73.047	25.996	76.228	27.101	79.443	28.289	82.687	29.559	85.957	30.908	33	
30	43.592	18.692	48.374	19.080	51.228	19.577	54.148	20.192	57.132	20.892	60.172	21.705	63.263	22.620	66.406	23.633	69.589	24.742	72.808	25.943	76.060	27.223	79.337	28.608	82.636	30.094	30	30 (H)**
25	36.199	15.760	42.210	16.224	45.124	16.818	48.113	17.538	51.170	18.363	54.287	19.347	57.458	20.425	60.678	21.629	63.948	22.917	67.267	24.317	70.635	25.812	73.840	27.397	77.169	29.065	25	
23	36.899	14.599	39.757	15.103	42.701	15.742	45.724	16.527	48.816	17.439	51.968	18.479	55.173	19.643	58.421	20.923	61.703	22.314	65.010	23.809	68.332	25.402	71.661	27.083			23	25 (P)*
20	33.195	12.877	36.099	13.454	39.097	14.190	42.177	15.080	45.328	16.117	48.539	17.295	51.797	18.606	55.091	20.043	58.407	21.594	61.735	23.252							20	25 (H)**
15	27.074	10.091	30.086	10.853	33.203	11.816	36.464	12.971	39.664	14.304	42.975	15.799	46.301	17.439													15	20 (P)*
14	25.482	9.554	28.902	10.367	32.049	11.394	35.327	12.620	38.563	14.030	41.853	15.605															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 103 Degrees

$\Delta = 103°$

Rc	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		Rc	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	3183.061	1516.137	3185.575	1516.159	3188.096	1516.182	3190.615	1516.207	3193.135	1516.233	3195.657	1516.261	3198.179	1516.289	3200.703	1516.320	3203.227	1516.351	3205.753	1516.384	3208.280	1516.418	3210.807	1516.453	3213.336	1516.490	2500	
2200	2805.927	1334.244	2809.447	1334.269	2810.968	1334.296	2813.490	1334.324	2816.013	1334.354	2818.537	1334.385	2821.063	1334.418	2823.589	1334.452	2826.117	1334.488	2828.646	1334.525	2831.176	1334.564	2833.707	1334.604	2836.240	1334.646	2200	
2000	2554.569	1212.987	2557.030	1213.014	2559.553	1213.043	2562.077	1213.074	2564.602	1213.107	2567.129	1213.141	2569.657	1213.177	2572.186	1213.215	2574.717	1213.254	2577.249	1213.295	2579.782	1213.338	2582.316	1213.382	2584.852	1213.428	2000	
1800	2303.093	1091.733	2305.647	1091.764	2308.142	1091.796	2310.669	1091.831	2313.197	1091.867	2315.727	1091.905	2318.258	1091.945	2320.790	1091.987	2323.324	1092.031	2325.859	1092.076	2328.396	1092.123	2330.934	1092.173	2333.474	1092.224	1800	
1500	1925.979	909.865	1928.507	909.902	1931.038	909.941	1933.570	909.982	1936.103	910.026	1938.639	910.071	1941.176	910.119	1943.715	910.169	1946.256	910.222	1948.798	910.277	1951.342	910.333	1953.888	910.392	1956.435	910.454	1500	
1200	1540.803	728.020	1551.419	728.067	1553.956	728.115	1556.496	728.167	1559.038	728.221	1561.583	728.278	1564.129	728.338	1566.678	728.401	1569.229	728.467	1571.781	728.535	1574.336	728.606	1576.893	728.680	1579.452	728.756	1200	
1000	1297.564	606.814	1300.047	606.870	1302.592	606.928	1305.140	606.990	1307.690	607.056	1310.243	607.124	1312.799	607.196	1315.357	607.271	1317.918	607.350	1320.481	607.432	1323.047	607.517	1325.615	607.606	1328.186	607.698	1000	
900	1171.823	546.224	1174.371	546.285	1176.921	546.350	1179.474	546.419	1182.031	546.491	1184.589	546.567	1187.151	546.647	1189.715	546.731	1192.281	546.818	1194.853	546.909	1197.426	547.004	1200.001	547.103	1202.580	547.205	900	
800	1046.152	485.644	1048.709	485.713	1051.262	485.787	1053.822	485.864	1056.385	485.946	1058.951	486.031	1061.520	486.121	1064.092	486.215	1066.668	486.313	1069.247	486.416	1071.828	486.522	1074.413	486.633	1077.002	486.748	800	
700	920.464	425.052	923.055	425.161	925.620	425.245	928.188	425.333	930.759	425.427	933.334	425.524	935.913	425.627	938.496	425.735	941.082	425.847	943.672	425.964	946.265	426.086	948.862	426.212	951.462	426.344	700	
600	794.855	364.545	797.426	364.638	800.001	364.735	802.580	364.838	805.164	364.947	807.751	365.061	810.343	365.181	812.939	365.307	815.539	365.438	818.143	365.574	820.752	365.716	823.364	365.864	825.981	366.017	600	
500	669.247	304.050	671.832	304.160	674.421	304.277	677.017	304.401	679.616	304.531	682.221	304.668	684.830	304.812	687.445	304.963	690.064	305.120	692.689	305.283	695.318	305.454	697.952	305.631	700.592	305.815	500	
400	543.693	243.625	546.298	243.763	548.909	243.909	551.527	244.064	554.151	244.227	556.781	244.398	559.417	244.578	562.060	244.766	564.708	244.962	567.362	245.167	570.022	245.380	572.688	245.601	575.361	245.831	400	
360	493.496	219.489	496.112	219.641	498.736	219.804	501.366	219.976	504.003	220.157	506.647	220.347	509.298	220.547	511.955	220.756	514.619	220.974	517.290	221.201	519.967	221.438	522.651	221.683	525.341	221.938	360	100 (P)**
350	480.959	213.458	483.570	213.616	486.197	213.783	488.831	213.960	491.471	214.146	494.119	214.342	496.774	214.547	499.436	214.762	502.104	214.986	504.779	215.220	507.461	215.463	510.150	215.716	512.846	215.978	350	
300	418.244	183.343	420.884	183.527	423.531	183.721	426.186	183.928	428.849	184.145	431.521	184.373	434.200	184.612	436.887	184.863	439.582	185.124	442.285	185.396	444.996	185.680	447.714	185.975	450.440	186.281	300	
250	355.598	151.308	358.264	153.529	360.939	153.763	363.624	154.010	366.318	154.270	369.022	154.544	371.735	154.831	374.457	155.131	377.189	155.444	379.929	155.771	382.679	156.110	385.438	156.463	388.205	156.829	250	
230	330.565	141.529	333.244	141.569	335.934	141.823	338.634	142.091	341.344	142.374	344.064	142.671	346.795	142.983	349.535	143.309	352.285	143.649	355.045	144.004	357.815	144.373	360.594	144.756	363.383	145.154	230	80 (P)*
200	293.055	123.416	295.760	123.691	298.476	123.983	301.204	124.292	303.943	124.616	306.694	124.958	309.456	125.316	312.230	125.690	315.014	126.081	317.809	126.488	320.615	126.912	323.433	127.352	326.260	127.808	200	
170	255.613	105.601	258.352	105.924	261.104	106.267	263.869	106.629	266.647	107.011	269.438	107.412	272.242	107.832	275.059	108.271	277.888	108.730	280.730	109.208	283.584	109.705	286.450	110.221	289.328	110.756	170	
155	236.931	96.747	239.690	97.101	242.464	97.477	245.253	97.874	248.055	98.292	250.872	98.731	253.702	99.191	256.546	99.673	259.404	100.175	262.274	100.698	265.158	101.242	268.055	101.807	270.964	102.392	155	65 (P)*
125	199.682	79.213	202.498	79.651	205.331	80.116	208.181	80.606	211.048	81.122	213.930	81.665	216.829	82.233	219.743	82.826	222.673	83.446	225.619	84.091	228.579	84.761	231.554	85.456	234.543	86.177	125	
100	168.838	64.898	171.723	65.443	174.627	66.021	177.552	66.631	180.495	67.272	183.457	67.946	186.437	68.651	189.435	69.387	192.451	70.154	195.484	70.952	198.533	71.781	201.598	72.641	204.678	73.530	100	
90	156.587	59.301	159.503	59.905	162.445	60.545	165.409	61.220	168.392	61.930	171.395	62.675	174.417	63.454	177.458	64.268	180.517	65.116	183.593	65.997	186.686	66.912	189.796	67.860	192.922	68.840	90	50 (P)
80	144.356	53.818	147.360	54.495	150.347	55.212	153.356	55.967	156.387	56.762	159.438	57.594	162.509	58.465	165.599	59.374	168.708	60.320	171.834	61.302	174.978	62.322	178.138	63.377	181.313	64.468	80	50 (H)**
70	132.304	48.496	135.321	49.265	138.362	50.079	141.426	50.936	144.512	51.837	147.619	52.780	150.747	53.765	153.894	54.792	157.060	55.869	160.243	56.969	163.442	58.118	166.657	59.306	169.887	60.533	70	
60	120.344	43.410	123.425	44.300	126.531	45.240	129.660	46.229	132.812	47.266	135.985	48.351	139.177	49.483	142.389	50.662	145.617	51.885	148.861	53.153	152.120	54.465	155.391	55.819	158.675	57.215	60	40 (P)*
55	114.431	40.994	117.549	41.959	120.691	42.976	123.858	44.046	127.046	45.168	130.255	46.340	133.482	47.562	136.727	48.832	139.988	50.149	143.262	51.513	146.549	52.922	149.847	54.375	153.154	55.870	55	
50	108.574	38.694	111.732	39.745	114.915	40.854	118.121	42.019	121.347	43.238	124.593	44.510	127.856	45.835	131.134	47.210	134.424	48.634	137.727	50.106	141.038	51.625	144.357	53.188	147.681	54.795	50	40 (H)**
45	102.785	36.543	105.987	37.698	109.213	38.914	112.459	40.189	115.725	41.522	119.006	42.911	122.302	44.355	125.609	45.850	128.925	47.396	132.248	48.991	135.575	50.632	138.904	52.318	142.235	54.046	45	35 (P)*
40	97.078	34.530	100.326	35.869	103.594	37.213	106.880	38.619	110.181	40.085	113.494	41.609	116.815	43.189	120.141	44.822	123.470	46.505	126.799	48.236							40	30 (H)**
35	91.465	32.507	94.757	34.335	98.064	35.831	101.382	37.391	104.707	39.012	108.036	40.692															35	
33	89.348	32.331	92.555	33.827	95.873	35.391	99.200	37.019	102.529	38.709																	33	30 (P)*
30	85.959	31.597	89.274	33.204	92.603	34.879																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 104 Degrees

△=104°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3239.985	1560.842	3242.503	1560.865	3245.021	1560.888	3247.541	1560.913	3250.062	1560.940	3252.584	1560.968	3255.106	1560.997	3257.630	1561.027	3260.155	1561.059	3262.681	1561.092	3265.208	1561.126	3267.736	1561.162	3270.266	1561.199	2500	
2200	2856.022	1373.585	2858.542	1373.611	2861.063	1373.638	2863.585	1373.666	2866.109	1373.696	2868.634	1373.728	2871.159	1373.761	2873.687	1373.795	2876.215	1373.832	2878.744	1373.869	2881.275	1373.908	2883.807	1373.949	2886.340	1373.991	2200	
2000	2600.049	1248.752	2602.571	1248.780	2605.094	1248.809	2607.619	1248.841	2610.145	1248.874	2612.672	1248.908	2615.201	1248.945	2617.730	1248.982	2620.267	1249.022	2622.794	1249.064	2625.328	1249.107	2627.863	1249.152	2630.399	1249.198	2000	
1800	2344.080	1123.922	2346.605	1123.953	2349.130	1123.986	2351.658	1124.021	2354.186	1124.058	2356.717	1124.096	2359.248	1124.136	2361.781	1124.179	2364.316	1124.223	2366.852	1124.269	2369.389	1124.317	2371.928	1124.362	2374.469	1124.418	1800	
1500	1960.136	936.690	1962.665	936.727	1965.196	936.767	1967.729	936.809	1970.263	936.853	1972.799	936.899	1975.337	936.948	1977.877	936.998	1980.418	937.051	1982.961	937.106	1985.506	937.164	1988.053	937.223	1990.601	937.286	1500	
1200	1576.210	749.482	1578.747	749.529	1581.285	749.578	1583.826	749.630	1586.369	749.685	1588.914	749.743	1591.461	749.803	1594.011	749.867	1596.563	749.933	1599.116	750.002	1601.672	750.074	1604.230	750.149	1606.791	750.226	1200	
1000	1320.279	624.701	1322.823	624.757	1325.369	624.816	1327.917	624.878	1330.469	624.945	1333.022	625.013	1335.579	625.086	1338.139	625.163	1340.700	625.242	1343.265	625.325	1345.832	625.411	1348.401	625.501	1350.973	625.594	1000	
900	1192.322	562.322	1194.871	562.384	1197.422	562.450	1199.976	562.519	1202.533	562.593	1205.093	562.670	1207.656	562.750	1210.221	562.835	1212.790	562.923	1215.361	563.015	1217.936	563.111	1220.513	563.211	1223.093	563.314	900	
800	1064.375	499.955	1066.929	500.025	1069.487	500.099	1072.048	500.177	1074.612	500.260	1077.179	500.347	1079.750	500.438	1082.323	500.533	1084.900	500.632	1087.480	500.736	1090.063	500.843	1092.650	500.956	1095.240	501.072	800	
700	936.441	437.606	939.003	437.686	941.569	437.771	944.138	437.860	946.711	437.954	949.288	438.053	951.868	438.157	954.452	438.266	957.040	438.379	959.631	438.497	962.226	438.621	964.825	438.749	967.427	438.882	700	
600	808.527	375.282	811.099	375.375	813.675	375.474	816.256	375.578	818.841	375.688	821.430	375.804	824.024	375.925	826.622	376.052	829.223	376.184	831.829	376.323	834.440	376.466	837.054	376.615	839.673	376.770	600	
500	680.644	313.000	683.230	313.111	685.821	313.230	688.418	313.355	691.020	313.487	693.626	313.625	696.238	313.771	698.854	313.923	701.476	314.082	704.103	314.247	706.735	314.420	709.372	314.599	712.013	314.785	500	
400	552.815	250.790	555.423	250.929	558.036	251.077	560.656	251.233	563.282	251.398	565.915	251.571	568.553	251.753	571.198	251.943	573.849	252.141	576.507	252.348	579.170	252.564	581.839	252.787	584.515	253.020	400	
360	501.710	225.939	504.328	226.094	506.954	226.258	509.587	226.432	512.226	226.615	514.873	226.808	517.527	227.009	520.187	227.220	522.854	227.441	525.528	227.670	528.208	227.910	530.896	228.158	533.590	228.416	360	100 (P)*
350	488.936	219.730	491.558	219.890	494.188	220.059	496.824	220.238	499.468	220.426	502.118	220.624	504.776	226.831	507.440	221.049	510.112	221.275	512.791	221.511	515.476	221.758	518.169	222.013	520.868	222.278	350	
300	425.095	188.723	427.737	188.909	430.387	189.106	433.045	189.314	435.712	189.534	438.386	189.765	441.069	190.007	443.760	190.260	446.458	190.524	449.165	190.800	451.880	191.086	454.602	191.384	457.333	191.693	300	
250	361.315	157.798	363.984	158.021	366.662	158.257	369.351	158.507	372.048	158.770	374.756	159.047	377.473	159.337	380.199	159.640	382.936	159.957	385.681	160.287	388.435	160.631	391.199	160.988	393.972	161.358	250	
230	335.828	145.463	338.511	145.705	341.204	145.962	343.908	146.233	346.622	146.519	349.347	146.820	352.081	147.135	354.826	147.464	357.581	147.809	360.346	148.167	363.121	148.540	365.906	148.928	368.700	149.330	230	80 (P)*
200	297.639	127.016	300.347	127.294	303.068	127.590	305.801	127.901	308.544	128.230	311.300	128.575	314.067	128.937	316.846	129.315	319.636	129.711	322.437	130.123	325.249	130.551	328.073	130.996	330.907	131.457	200	
170	259.520	108.668	262.263	108.995	265.020	109.342	267.790	109.708	270.573	110.094	273.370	110.500	276.180	110.925	279.003	111.369	281.839	111.833	284.687	112.316	287.548	112.818	290.422	113.340	293.308	113.881	170	
155	240.499	99.549	243.264	99.908	246.043	100.288	248.837	100.689	251.646	101.112	254.468	101.556	257.305	102.021	260.156	102.508	263.021	103.015	265.898	103.544	268.790	104.094	271.695	104.665	274.612	105.257	155	65 (P)*
125	202.377	81.486	205.399	81.929	208.239	82.399	211.095	82.895	213.969	83.417	216.860	83.965	219.766	84.540	222.689	85.140	225.628	85.766	228.582	86.418	231.552	87.096	234.537	87.799	237.536	88.527	125	
100	171.175	66.733	174.068	67.285	176.981	67.869	179.913	68.486	182.866	69.134	185.837	69.815	188.828	70.528	191.836	71.272	194.863	72.048	197.907	72.855	200.967	73.693	204.045	74.562	207.138	75.462	100	
90	158.698	60.963	161.628	61.574	164.579	62.221	167.552	62.904	170.545	63.621	173.559	64.375	176.592	65.163	179.644	65.985	182.715	66.842	185.804	67.733	188.910	68.658	192.034	69.617	195.173	70.608	90	50 (P)
80	146.293	55.308	149.267	55.992	152.264	56.717	155.284	57.481	158.325	58.284	161.388	59.126	164.471	60.007	167.574	60.925	170.697	61.882	173.837	62.875	176.995	63.906	180.170	64.973	183.361	66.076	80	50 (H)**
70	133.984	49.815	137.011	50.593	140.064	51.415	143.140	52.282	146.239	53.193	149.359	54.146	152.501	55.143	155.663	56.181	158.843	57.261	162.042	58.382	165.258	59.544	168.490	60.745	171.737	61.986	70	
60	121.810	44.562	124.903	45.461	128.022	46.411	131.166	47.411	134.332	48.460	137.521	49.557	140.729	50.702	143.957	51.894	147.203	53.131	150.465	54.413	153.742	55.739	157.033	57.109	160.336	58.520	60	40 (P)*
55	115.792	42.063	118.923	43.038	122.080	44.067	125.262	45.149	128.466	46.283	131.691	47.468	134.936	48.703	138.199	49.987	141.478	51.320	144.772	52.699	148.079	54.123	151.397	55.592	154.725	57.104	55	
50	109.831	39.681	113.004	40.744	116.203	41.865	119.425	43.043	122.669	44.276	125.933	45.562	129.214	46.902	132.511	48.292	135.822	49.732	139.145	51.221	142.478	52.756	145.819	54.337	149.166	55.961	50	40 (H)**
45	103.941	37.450	107.159	38.618	110.402	39.848	113.667	41.138	116.951	42.486	120.252	43.890	123.568	45.349	126.896	46.861	130.234	48.425	133.580	50.037	136.930	51.696	140.283	53.401	143.636	55.149	45	35 (P)*
40	98.135	35.421	101.401	36.714	104.689	38.072	107.995	39.494	111.316	40.977	114.650	42.518	117.994	44.115	121.343	45.766	124.696	47.468	128.049	49.218	131.400	51.014					40	30 (H)**
35	92.428	33.663	95.740	35.107	99.068	36.619	102.408	38.196	105.756	39.836	109.109	41.534															35	
33	90.174	33.059	93.502	34.571	96.843	36.152	100.192	37.799	103.545	39.507																	33	30 (P)*
30	86.823	32.283	90.170	33.907	93.522	35.601																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 104 Degrees

$\Delta = 104°$

R_c	$L_s = 80$ metres		$L_s = 85$ metres		$L_s = 90$ metres		$L_s = 95$ metres		$L_s = 100$ metres		$L_s = 105$ metres		$L_s = 110$ metres		$L_s = 115$ metres		$L_s = 120$ metres		$L_s = 125$ metres		$L_s = 130$ metres		$L_s = 135$ metres		$L_s = 140$ metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s				
metre																									metre			
2500	3239.985	1560.842	3242.503	1560.865	3245.021	1560.888	3247.541	1560.913	3250.062	1560.940	3252.584	1560.968	3255.106	1560.997	3257.630	1561.027	3260.155	1561.059	3262.681	1561.092	3265.208	1561.126	3267.736	1561.162	3270.266	1561.199	2500	
2100	2856.022	1373.585	2858.542	1373.611	2861.063	1373.638	2863.585	1373.666	2866.109	1373.696	2868.634	1373.728	2871.159	1373.761	2873.687	1373.795	2876.215	1373.832	2878.744	1373.869	2881.275	1373.908	2883.807	1373.949	2886.340	1373.991	2100	
2000	2600.049	1248.732	2602.571	1248.760	2605.094	1248.809	2607.619	1248.841	2610.145	1248.874	2612.672	1248.908	2615.201	1248.945	2617.730	1248.982	2620.260	1249.022	2622.794	1249.064	2625.328	1249.107	2627.863	1249.152	2630.399	1249.198	2000	
1800	2344.080	1123.932	2346.603	1123.953	2349.130	1123.986	2351.658	1124.021	2354.186	1124.058	2356.717	1124.096	2359.248	1124.136	2361.781	1124.179	2364.316	1124.223	2366.852	1124.269	2369.389	1124.317	2371.928	1124.367	2374.469	1124.418	1800	
1500	1960.136	936.690	1962.665	936.727	1965.196	936.767	1967.729	936.809	1970.263	936.853	1972.799	936.899	1975.337	936.948	1977.877	936.998	1980.418	937.051	1982.961	937.106	1985.506	937.164	1988.053	937.223	1990.601	937.286	1500	
1200	1576.210	749.482	1578.747	749.529	1581.285	749.578	1583.826	749.630	1586.369	749.685	1588.914	749.743	1591.461	749.803	1594.011	749.867	1596.563	749.933	1599.116	750.002	1601.672	750.074	1604.230	750.149	1606.791	750.226	1200	
1000	1320.279	624.701	1322.823	624.757	1325.369	624.816	1327.917	624.878	1330.469	624.945	1333.022	625.013	1335.579	625.086	1338.139	625.163	1340.700	625.242	1343.265	625.325	1345.832	625.411	1348.401	625.501	1350.973	625.594	1000	
900	1192.322	562.322	1194.871	562.384	1197.422	562.450	1199.976	562.519	1202.533	562.593	1205.093	562.670	1207.656	562.750	1210.221	562.835	1212.790	562.923	1215.361	563.015	1217.936	563.111	1220.513	563.211	1223.093	563.314	900	
800	1064.375	499.935	1066.929	500.025	1069.487	500.099	1072.048	500.177	1074.612	500.260	1077.179	500.347	1079.750	500.438	1082.323	500.533	1084.900	500.632	1087.480	500.736	1090.063	500.843	1092.650	500.956	1095.240	501.072	800	
700	936.441	437.606	939.003	437.686	941.569	437.771	944.138	437.860	946.711	437.954	949.288	438.053	951.868	438.157	954.452	438.266	957.040	438.379	959.631	438.497	962.226	438.621	964.825	438.749	967.427	438.882	700	
600	808.527	375.282	811.099	375.375	813.675	375.474	816.256	375.578	818.841	375.688	821.430	375.804	824.024	375.925	826.622	376.052	829.223	376.184	831.829	376.323	834.440	376.466	837.054	376.615	839.673	376.770	600	
500	680.644	313.000	683.230	313.111	685.821	313.230	688.418	313.355	691.020	313.487	693.626	313.625	696.238	313.771	698.854	313.923	701.476	314.082	704.103	314.247	706.735	314.420	709.372	314.599	712.013	314.785	500	
400	552.815	250.790	555.423	250.929	558.036	251.077	560.656	251.233	563.282	251.398	565.915	251.571	568.553	251.753	571.198	251.943	573.849	252.141	576.507	252.348	579.170	252.564	581.839	252.787	584.515	253.020	400	
360	501.710	225.939	504.328	226.064	506.954	226.238	509.587	226.432	512.226	226.615	514.873	226.808	517.527	227.009	520.187	227.220	522.854	227.441	525.528	227.670	528.208	227.910	530.896	228.158	533.590	228.416	360	100 (P)*
350	488.936	219.730	491.558	219.890	494.188	220.059	496.824	220.238	499.468	220.426	502.118	220.624	504.776	226.831	507.440	221.049	510.112	221.275	512.791	221.511	515.476	221.758	518.169	222.013	520.868	222.278	350	
300	425.095	188.723	427.737	188.909	430.387	189.106	433.045	189.314	435.712	189.534	438.386	189.765	441.069	190.007	443.760	190.260	446.458	190.524	449.165	190.800	451.880	191.086	454.602	191.384	457.333	191.693	300	
250	361.315	157.798	363.984	158.021	366.662	158.257	369.351	158.507	372.048	158.770	374.756	159.047	377.473	159.337	380.199	159.640	382.936	159.957	385.681	160.287	388.435	160.631	391.199	160.988	393.972	161.358	250	
230	333.828	145.463	338.511	145.705	341.204	145.962	343.908	146.233	346.622	146.519	349.347	146.820	352.081	147.135	354.826	147.464	357.581	147.809	360.346	148.167	363.121	148.540	365.906	148.928	368.700	149.330	230	80 (P)*
200	297.639	127.016	300.347	127.204	303.068	127.390	305.801	127.901	308.544	128.230	311.300	128.575	314.067	128.937	316.846	129.315	319.636	129.711	322.437	130.123	325.249	130.551	328.073	130.996	330.907	131.457	200	
170	259.520	108.668	262.263	108.995	265.020	109.342	267.790	109.708	270.573	110.094	273.370	110.500	276.180	110.925	279.003	111.369	281.839	111.833	284.687	112.316	287.548	112.818	290.422	113.340	293.308	113.881	170	
155	240.499	99.549	243.264	99.908	246.043	100.288	248.837	100.689	251.646	101.112	254.468	101.556	257.305	102.021	260.156	102.508	263.021	103.015	265.898	103.544	268.790	104.094	271.695	104.665	274.612	105.257	155	65 (P)*
125	202.517	81.486	205.399	81.929	208.239	82.399	211.095	82.895	213.969	83.417	216.860	83.965	219.766	84.540	222.689	85.140	225.628	85.766	228.582	86.418	231.552	87.096	234.537	87.799	237.536	88.527	125	
100	171.175	66.733	174.068	67.285	176.981	67.869	179.913	68.486	182.866	69.134	185.837	69.815	188.828	70.528	191.836	71.272	194.863	72.048	197.907	72.855	200.967	73.693	204.045	74.562	207.138	75.462	100	
90	158.698	60.963	161.628	61.574	164.579	62.221	167.552	62.904	170.545	63.621	173.559	64.375	176.592	65.163	179.644	65.985	182.715	66.842	185.804	67.733	188.910	68.658	192.034	69.617	195.173	70.608	90	50 (P)
80	146.293	55.308	149.267	55.992	152.264	56.717	155.284	57.481	158.325	58.284	161.388	59.126	164.471	60.007	167.574	60.925	170.697	61.882	173.837	62.875	176.995	63.906	180.170	64.973	183.361	66.076	80	50 (H)**
70	133.984	49.815	137.011	50.593	140.064	51.415	143.140	52.282	146.239	53.193	149.359	54.146	152.501	55.143	155.663	56.181	158.843	57.261	162.042	58.382	165.258	59.544	168.490	60.745	171.737	61.986	70	
60	121.810	44.362	124.903	45.461	128.022	46.411	131.166	47.411	134.332	48.460	137.521	49.557	140.729	50.702	143.957	51.894	147.203	53.131	150.465	54.413	153.742	55.739	157.033	57.109	160.336	58.520	60	40 (P)*
55	115.792	42.063	118.923	43.038	122.080	44.067	125.262	45.149	128.466	46.283	131.691	47.468	134.936	48.703	138.199	49.987	141.478	51.320	144.772	52.699	148.079	54.123	151.397	55.592	154.725	57.104	55	
50	109.831	39.681	113.004	40.744	116.203	41.865	119.425	43.043	122.669	44.276	125.933	45.562	129.214	46.902	132.511	48.292	135.822	49.732	139.145	51.221	142.478	52.756	145.819	54.337	149.166	55.961	50	40 (H)**
45	103.941	37.450	107.159	38.618	110.402	39.848	113.667	41.138	116.951	42.486	120.252	43.890	123.568	45.349	126.896	46.861	130.234	48.425	133.580	50.037	136.930	51.696	140.283	53.401	143.636	55.149	45	35 (P)*
40	98.135	35.421	101.401	36.714	104.689	38.072	107.995	39.494	111.316	40.977	114.650	42.518	117.994	44.115	121.343	45.766	124.696	47.468	128.049	49.218	131.400	51.014					40	30 (H)**
35	92.428	33.663	95.740	35.107	99.068	36.619	102.408	38.196	105.756	39.836	109.109	41.534															35	
33	90.174	33.059	93.502	34.571	96.843	36.152	100.192	37.799	103.545	39.507																	33	30 (P)*
30	86.822	32.283	90.170	33.907	93.522	35.601																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 105 Degrees

$\Delta = 105°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	3265.562	1606.699	3268.065	1606.703	3270.570	1606.711	3273.076	1606.719	3275.583	1606.727	3278.091	1606.738	3280.601	1606.750	3283.111	1606.762	3285.623	1606.777	3258.135	1606.793	3290.648	1606.809	3293.163	1606.828	3295.678	1606.848	2500	
2200	2874.395	1413.897	2877.100	1413.903	2879.805	1413.909	2882.512	1413.918	2884.620	1413.928	2887.129	1413.940	2889.640	1413.953	2892.152	1413.968	2894.664	1413.984	2897.178	1414.002	2899.694	1414.022	2902.210	1414.042	2904.728	1414.065	2200	
2000	2613.951	1285.362	2616.456	1285.368	2618.962	1285.376	2621.470	1285.385	2623.979	1285.397	2626.489	1285.410	2629.000	1285.424	2631.513	1285.440	2634.027	1285.458	2636.543	1285.478	2639.060	1285.500	2641.578	1285.522	2644.098	1285.547	2000	
1800	2353.307	1156.928	2355.812	1156.834	2358.320	1156.843	2360.828	1156.853	2363.338	1156.866	2365.849	1156.880	2368.362	1156.896	2370.876	1156.914	2373.392	1156.934	2375.909	1156.956	2378.428	1156.980	2380.948	1157.006	2383.470	1157.033	1800	
1500	1962.342	964.026	1964.849	965.034	1967.357	964.044	1969.866	964.057	1972.378	964.072	1974.892	964.089	1977.407	964.108	1979.924	964.130	1982.443	964.154	1984.964	964.180	1987.487	964.209	1990.011	964.240	1992.537	964.273	1500	
1200	1571.377	771.226	1573.885	771.236	1576.396	771.249	1578.908	771.264	1581.423	771.282	1583.939	771.304	1586.458	771.328	1588.980	771.355	1591.503	771.385	1594.029	771.418	1596.558	771.454	1599.088	771.492	1601.621	771.534	1200	
1000	1310.735	642.693	1313.244	642.705	1315.757	642.720	1318.272	642.739	1320.789	642.761	1323.309	642.787	1325.832	642.816	1328.358	642.849	1330.886	642.884	1333.417	642.924	1335.951	642.967	1338.487	643.013	1341.026	643.062	1000	
900	1180.414	578.427	1182.925	578.440	1185.438	578.457	1187.955	578.478	1190.474	578.503	1192.997	578.531	1195.522	578.563	1198.051	578.600	1200.582	578.640	1203.116	578.684	1205.654	578.731	1208.194	578.782	1210.738	578.837	900	
800	1050.094	514.161	1052.605	514.176	1055.120	514.195	1057.639	514.219	1060.161	514.247	1062.686	514.279	1065.215	514.315	1067.747	514.356	1070.282	514.401	1072.821	514.450	1075.363	514.503	1077.908	514.561	1080.457	514.623	800	
700	919.773	449.896	922.287	449.913	924.804	449.935	927.325	449.962	929.851	449.994	932.379	450.031	934.912	450.072	937.449	450.118	939.989	450.170	942.533	450.226	945.081	450.287	947.633	450.353	950.188	450.424	700	100 (P)*
650	789.454	385.632	791.970	385.652	794.490	385.678	797.015	385.709	799.544	385.746	802.078	385.789	804.616	385.837	807.158	385.892	809.705	385.951	812.257	386.017	814.813	386.088	817.373	386.166	819.938	386.248	650	
600	659.136	321.370	661.655	321.394	664.179	321.424	666.708	321.462	669.244	321.506	671.784	321.558	674.330	321.616	676.881	321.681	679.437	321.752	681.999	321.832	684.565	321.917	687.138	322.009	689.715	322.109	600	
500	528.820	257.109	531.342	257.139	533.874	257.178	536.410	257.225	538.954	257.281	541.505	257.345	544.062	257.417	546.625	257.499	549.195	257.588	551.772	257.687	554.355	257.794	556.945	257.909	559.541	258.033	500	
450	476.694	231.407	479.220	231.440	481.754	231.482	484.295	231.535	486.844	231.597	489.399	231.668	491.963	231.749	494.533	231.839	497.111	231.939	499.696	232.048	502.288	232.167	504.888	232.295	507.495	232.433	450	
400	463.663	224.861	466.190	225.015	468.724	225.059	471.267	225.113	473.816	225.177	476.374	225.250	478.939	225.333	481.512	225.426	484.092	225.529	486.679	225.641	489.274	225.763	491.876	225.895	494.486	226.037	400	
300	398.307	192.854	401.039	192.895	403.579	192.946	406.128	193.009	408.687	193.083	411.253	193.168	413.829	193.265	416.413	193.374	419.006	193.495	421.608	193.629	424.219	193.767	426.837	193.920	429.465	194.086	300	80 (P)*
250	333.594	160.731	335.902	160.779	338.440	160.840	341.000	160.916	343.569	161.005	346.149	161.107	348.739	161.224	351.340	161.354	353.951	161.497	356.573	161.654	359.205	161.825	361.846	162.010	364.498	162.208	250	
230	307.294	147.883	309.815	147.935	312.387	148.002	314.951	148.083	317.527	148.180	320.114	148.292	322.712	148.418	325.322	148.559	327.942	148.716	330.573	148.886	333.216	149.072	335.870	149.273	338.535	149.488	230	
200	268.205	128.612	270.552	128.672	273.313	128.749	275.886	128.844	278.473	128.955	281.072	129.083	283.685	129.228	286.310	129.391	288.948	129.570	291.599	129.767	294.262	129.980	296.938	130.210	299.626	130.458	200	
170	229.119	109.346	231.636	109.416	234.245	109.501	236.831	109.617	239.433	109.748	242.049	109.899	244.681	110.070	247.328	110.261	249.989	110.472	252.665	110.703	255.356	110.954	258.061	111.225	260.781	111.516	170	65 (P)*
150	200.778	95.714	212.130	95.792	214.716	99.891	217.310	100.012	219.921	100.156	222.549	100.321	225.193	100.509	227.853	100.718	230.529	100.949	233.222	101.203	235.930	101.478	238.654	101.775	241.393	102.094	155	*
125	170.500	80.438	173.074	80.554	175.670	80.677	178.286	80.827	180.923	81.005	183.580	81.210	186.257	81.442	188.954	81.702	191.670	81.988	194.406	82.302	197.161	82.643	199.934	83.010	202.726	83.405	125	
100	137.943	64.422	140.536	64.541	143.155	64.695	145.799	64.883	148.469	65.105	151.163	65.361	153.882	65.651	156.625	65.975	159.391	66.333	162.181	66.724	164.994	67.149	167.829	67.607	170.686	68.098	100	
90	124.924	58.012	127.527	58.145	130.159	58.316	132.819	58.525	135.506	58.771	138.221	59.056	140.962	59.378	143.730	59.717	146.524	60.158	149.343	60.568	152.187	61.039	155.055	61.547	157.947	62.092	90	50 (P)*
80	111.908	51.607	114.520	51.756	117.122	51.948	119.850	52.183	122.560	52.460	125.303	52.780	128.069	53.142	130.868	53.546	133.694	53.991	136.549	54.479	139.431	55.008	142.339	55.578	145.273	56.189	80	50 (H)**
70	98.897	45.207	101.529	45.378	104.197	45.598	106.900	45.866	109.637	46.183	112.409	46.547	115.213	46.960	118.050	47.421	120.918	47.930	123.817	48.484	126.746	49.087	129.705	49.736	132.689	50.431	70	
60	85.893	38.817	88.546	39.016	91.240	39.272	93.975	39.585	96.749	39.954	99.562	40.379	102.412	40.859	105.298	41.395	108.219	41.986	111.174	42.631	114.162	43.330	117.181	44.083	120.231	44.889	60	40 (P)*
55	79.395	35.671	82.061	35.884	84.772	36.124	87.526	36.464	90.323	36.865	93.162	37.329	96.040	37.852	98.956	38.436	101.910	39.078	104.899	39.780	107.922	40.540	110.978	41.358	114.066	42.232	55	
50	72.901	32.442	75.562	32.661	78.317	32.958	81.091	33.362	83.914	33.803	86.783	34.312	89.693	34.886	92.645	35.526	95.636	36.230	98.665	36.999	101.729	37.831	104.827	38.725	107.956	39.681	50	40 (H)**
45	66.409	29.292	69.110	29.528	71.865	29.868	74.671	30.284	77.527	30.774	80.431	31.337	83.381	31.973	86.374	32.681	89.405	33.561	92.482	34.310	95.592	35.228	98.738	36.214	101.917	37.267	45	35 (P)*
40	59.925	26.092	62.630	26.340	65.434	26.723	68.275	27.239	71.169	27.789	74.116	28.421	77.112	29.133	80.154	29.926	83.239	30.797	86.365	31.745	89.529	32.769	92.727	33.866	95.958	35.036	40	35 (H) 30 (P)*
35	53.450	22.913	56.204	23.271	59.028	23.710	61.909	24.242	64.852	24.868	67.851	25.586	70.902	26.396	74.002	27.295	77.148	28.281	80.334	29.352	83.557	30.506	86.814	31.741	90.100	33.054	35	
33	50.865	21.956	53.613	22.093	56.470	22.498	59.374	23.001	62.329	23.724	65.362	24.484	68.439	25.339	71.566	26.289	74.738	27.329	77.953	28.459	81.209	29.674	84.461	30.973	87.789	32.352	33	
30	46.987	19.790	49.781	20.097	52.649	20.697	55.587	21.315	58.591	22.041	61.655	22.873	64.774	23.809	67.943	24.845	71.158	25.978	74.417	27.207	77.701	28.526	81.018	29.932	84.356	31.421	30	30 (H)**
25	40.545	16.681	43.193	17.156	46.223	17.763	49.232	18.500	52.413	19.363	55.558	20.349	58.760	21.453	62.010	22.672	65.302	24.000	68.626	25.431	71.976	26.960	75.343	28.581	78.719	30.287	25	
23	37.927	15.444	40.649	15.964	43.512	16.622	46.857	17.420	49.975	18.353	53.138	19.416	56.396	20.606	59.684	21.915	63.002	23.336	66.352	24.867	69.730	26.495	73.097	28.215			23	25 (P)*
20	32.311	13.124	34.859	14.019	46.077	14.964	43.183	15.872	46.364	16.934	49.609	18.138	52.904	19.479	56.249	20.947	59.603	23.534	62.975	24.229							20	25 (H)**
15	27.196	11.058	29.858	12.037	32.771	12.422	35.706	13.607	38.669	14.966	41.659	16.394	44.679	18.172													15	20 (P)*
14	25.446	10.366	28.111	11.318	30.800	11.968	33.511	13.224	36.247	14.663	39.007	16.274	41.792	18.274													14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 105 Degrees

$\Delta = 105°$

R	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		Rc	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	3298.196	1698.867	3300.713	1696.891	3303.232	1696.914	3305.752	1696.941	3308.273	1696.969	3310.795	1696.996	3313.318	1697.023	3315.843	1697.055	3318.368	1697.086	3320.895	1697.121	3323.422	1697.156	3325.951	1697.191	3328.481	1697.230	2500	
2400	2907.267	1414.285	2909.768	1414.115	2912.289	1414.142	2914.812	1414.171	2917.336	1414.201	2919.861	1414.233	2922.387	1414.267	2924.915	1414.302	2927.444	1414.338	2929.974	1414.376	2932.505	1414.416	2935.038	1414.457	2937.571	1414.500	2400	
2300	2646.619	1285.573	2649.141	1285.632	2651.665	1285.692	2654.189	1285.863	2656.716	1285.697	2659.243	1285.732	2661.772	1285.769	2664.303	1285.807	2666.835	1285.847	2669.367	1285.889	2671.902	1285.933	2674.438	1285.978	2676.974	1286.025	2300	
2200	2385.993	1157.063	2388.518	1157.094	2391.044	1157.127	2393.572	1157.162	2396.101	1157.199	2398.632	1157.238	2401.164	1157.279	2403.698	1157.322	2406.233	1157.367	2408.770	1157.413	2411.308	1157.462	2413.847	1157.512	2416.388	1157.564	2200	
2100	1995.065	964.308	1997.594	964.346	2000.126	964.386	2002.659	964.428	2005.194	964.472	2007.731	964.519	2010.270	964.568	2012.810	964.620	2015.352	964.673	2017.896	964.729	2020.442	964.787	2022.989	964.847	2025.538	964.910	2100	
2000	1604.157	771.578	1606.693	771.625	1609.231	771.675	1611.773	771.727	1614.317	771.783	1616.863	771.842	1619.411	771.903	1621.961	771.967	1624.514	772.034	1627.069	772.104	1629.625	772.177	1632.185	772.252	1634.746	772.331	2000	
1900	1343.558	643.115	1346.111	643.172	1348.659	643.231	1351.209	643.295	1353.762	643.362	1356.316	643.432	1358.874	643.505	1361.434	643.583	1363.997	643.663	1366.563	643.747	1369.131	643.834	1371.702	643.925	1374.275	644.018	1900	
1800	1213.284	578.896	1215.833	578.939	1218.383	579.026	1220.940	579.096	1223.499	579.170	1226.060	579.248	1228.624	579.330	1231.190	579.415	1233.760	579.504	1236.333	579.597	1238.909	579.695	1241.487	579.795	1244.069	579.900	1800	
1700	1083.009	514.689	1085.564	514.760	1088.123	514.835	1090.685	514.914	1093.250	514.997	1095.819	515.085	1098.391	515.177	1100.966	515.272	1103.544	515.372	1106.126	515.479	1108.710	515.587	1111.299	515.701	1113.890	515.818	1700	
1600	952.148	450.500	954.711	450.580	957.279	450.666	959.848	450.756	962.423	450.852	965.001	450.953	967.583	451.057	970.169	451.167	972.758	451.282	975.351	451.401	977.948	451.526	980.548	451.656	983.152	451.790	1600	
1500	822.907	386.350	825.480	386.430	828.059	386.520	830.640	386.636	833.227	386.747	835.818	386.864	838.413	386.986	840.013	387.115	843.217	387.249	845.824	387.388	848.437	387.533	851.054	387.685	853.675	387.841	1500	
1400	692.298	322.215	694.885	322.327	697.479	322.447	700.077	322.574	702.680	322.707	705.289	322.847	707.903	322.994	710.521	323.148	713.145	323.309	715.775	323.476	718.409	323.651	721.048	323.832	723.693	324.020	1400	
1300	562.164	258.166	564.753	258.307	567.369	258.456	569.991	258.615	572.620	258.781	575.255	258.956	577.896	259.140	580.544	259.333	583.197	259.533	585.858	259.742	588.524	259.960	591.197	260.186	593.876	260.421	1300	
1200	510.109	232.580	512.729	232.737	515.358	232.903	517.993	233.079	520.635	233.264	523.285	233.458	525.941	233.663	528.604	233.876	531.275	234.099	533.952	234.331	536.636	234.573	539.327	234.824	542.024	235.085	1200	100 (P)**
1100	457.103	206.188	459.755	206.340	462.359	206.500	465.008	206.668	467.645	206.891	470.298	207.092	472.958	207.301	475.626	207.521	478.301	207.750	480.983	207.989	483.672	208.238	486.368	208.496	489.071	208.765	1100	
1000	432.101	194.263	434.765	194.450	437.398	194.650	440.000	194.861	442.729	195.082	445.407	195.316	448.093	195.560	450.787	195.817	453.490	196.084	456.200	196.363	458.919	196.652	461.646	196.954	464.381	197.266	1000	
950	369.183	165.420	369.832	165.645	372.514	166.894	375.206	163.137	377.908	163.403	380.619	163.683	383.341	163.976	386.072	164.285	388.812	164.606	391.562	164.937	394.321	165.285	397.090	165.646	399.868	166.021	950	
900	341.210	149.718	343.896	149.903	346.594	150.323	349.301	150.497	352.020	150.787	354.748	151.091	357.487	151.409	360.237	151.743	362.997	152.091	365.767	152.453	368.547	152.831	371.337	153.223	374.138	153.629	900	80 (P)*
850	302.326	130.723	305.039	131.004	307.764	131.302	310.501	131.618	313.250	131.950	316.010	132.299	318.782	132.665	321.567	133.048	324.362	133.448	327.169	133.864	329.987	134.297	332.817	134.747	335.658	135.214	850	
800	263.314	111.827	266.262	112.157	269.024	112.509	271.799	112.879	274.588	113.269	277.391	113.679	280.207	114.109	283.036	114.558	285.879	115.027	288.734	115.516	291.603	116.024	294.483	116.552	297.377	117.099	800	
750	244.148	102.434	246.918	102.797	249.703	103.181	252.502	103.587	255.317	104.014	258.146	104.464	260.990	104.934	263.847	105.426	266.719	105.940	269.604	106.475	272.504	107.031	275.417	107.608	278.343	108.207	750	65 (P)*
700	203.537	83.826	206.365	84.274	211.212	84.749	214.075	85.251	216.957	85.779	219.855	86.334	222.770	86.914	225.701	87.522	228.649	88.155	231.613	88.814	234.592	89.500	237.587	90.211	240.597	90.947	700	
650	173.565	68.823	176.466	69.181	179.387	69.772	182.329	70.395	185.290	71.051	188.272	71.740	191.272	72.461	194.291	73.213	197.329	73.998	200.384	74.814	203.457	75.662	206.547	76.541	209.653	77.451	650	
600	160.882	62.674	163.801	63.292	166.761	63.948	169.744	64.637	172.747	65.363	175.772	66.124	178.816	66.921	181.880	67.753	184.964	68.620	188.065	69.521	191.185	70.457	194.322	71.426	197.475	72.429	600	50 (P)
550	148.232	56.941	151.216	57.534	154.224	58.266	157.254	59.039	160.307	59.851	163.382	60.703	166.478	61.593	169.595	62.522	172.730	63.490	175.885	64.495	179.058	65.537	182.248	66.616	185.455	67.732	550	50 (H)**
500	135.501	51.713	138.560	51.968	141.604	52.797	144.893	53.668	148.005	54.589	151.139	55.553	154.295	56.561	157.472	57.611	160.668	58.704	163.882	59.838	167.115	61.012	170.364	62.227	173.629	63.482	500	40 (P)*
450	123.309	45.747	126.415	46.656	129.548	47.617	132.705	48.628	135.887	49.689	139.091	50.799	142.316	51.957	145.561	53.162	148.825	54.413	152.105	55.710	155.401	57.051	158.712	58.436	162.035	59.863	450	40 (P)*
400	117.133	43.163	120.228	44.149	123.500	45.190	126.697	46.284	129.918	47.431	133.160	48.629	136.423	49.879	139.704	51.177	143.002	52.523	146.316	53.919	149.643	55.360	152.982	56.846	156.332	58.375	400	
350	111.117	40.697	114.305	41.773	117.520	42.907	120.759	44.097	124.020	45.344	127.303	46.645	130.603	48.000	133.920	49.406	137.252	50.863	140.596	52.368	143.951	53.921	147.315	55.519	150.685	57.162	350	40 (H)**
300	105.123	38.385	108.208	39.566	111.618	40.810	114.902	42.114	118.205	43.477	121.526	44.897	124.863	46.373	128.213	47.902	131.574	49.483	134.942	51.114	138.316	52.792	141.694	54.516	145.072	56.284	300	35 (P)*
250	99.216	36.225	102.501	37.585	105.808	38.957	109.134	40.395	112.477	41.894	115.833	43.455	119.199	45.068	122.573	46.732	125.960	48.459	129.358	50.229							250	30 (H)**
200	93.412	34.441	96.744	35.901	100.094	37.431	103.457	39.026	106.829	40.684	110.206	42.402															200	25 (P)*
175	91.121	33.807	94.471	35.337	97.834	36.936	101.207	38.601	104.584	40.329																	175	20 (P)*
150	87.716	32.989	91.086	34.632	94.462	36.344																					150	20 (H)**
125																											125	20 (P)*
100																											100	15 (P)*
90																											90	15 (H)**
80																											80	15 (P)*
75																											75	15 (H)**
70																											70	15 (P)*
65																											65	15 (H)**
60																											60	15 (P)*
55																											55	15 (H)**
50																											50	15 (P)*
45																											45	15 (H)**
40																											40	15 (P)*
35																											35	15 (H)**
30																											30	15 (P)*

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 106 Degrees

$\Delta = 106°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3323.114	1654.105	3327.618	1654.109	3330.123	1654.117	3332.629	1654.121	3335.136	1654.133	3337.644	1654.141	3340.154	1654.152	3342.664	1654.168	3345.176	1654.184	3347.688	1654.199	3350.202	1654.215	3352.717	1654.234	3355.233	1654.254	2500	
2286	2927.001	1455.613	2929.506	1455.619	2932.011	1455.626	2934.519	1455.635	2937.027	1455.645	2939.536	1455.656	2942.047	1455.670	2944.559	1455.685	2947.072	1455.702	2949.586	1455.719	2952.102	1455.739	2954.619	1455.760	2957.137	1455.783	2286	
2000	2661.593	1323.286	2664.098	1323.292	2666.604	1323.300	2669.112	1323.310	2671.621	1323.321	2674.131	1323.334	2676.643	1323.349	2679.156	1323.365	2681.670	1323.383	2684.186	1323.403	2686.704	1323.425	2689.222	1323.448	2691.742	1323.473	2000	
1800	2396.188	1190.959	2398.691	1190.966	2401.196	1190.975	2403.706	1190.985	2406.216	1190.998	2408.728	1191.012	2411.240	1191.029	2413.755	1191.047	2416.271	1191.067	2418.789	1191.089	2421.308	1191.113	2423.829	1191.139	2426.351	1191.167	1800	
1500	1998.074	992.469	2000.580	992.478	2003.088	992.488	2005.598	992.500	2008.110	992.515	2010.624	992.533	2013.140	992.552	2015.657	992.574	2018.177	992.598	2020.698	992.625	2023.221	992.654	2025.745	992.685	2028.272	992.719	1500	
1200	1599.863	793.980	1602.471	793.990	1604.981	794.001	1607.494	794.019	1610.009	794.038	1612.526	794.060	1615.045	794.084	1617.567	794.112	1620.091	794.142	1622.617	794.175	1625.146	794.211	1627.677	794.250	1630.210	794.292	1200	
1000	1334.356	661.655	1337.066	661.667	1339.578	661.683	1342.094	661.702	1344.611	661.724	1347.132	661.750	1349.655	661.780	1352.181	661.812	1354.710	661.849	1357.241	661.888	1359.776	661.932	1362.313	661.978	1364.853	662.029	1000	
900	1201.853	595.493	1204.364	595.506	1206.878	595.524	1209.394	595.545	1211.914	595.569	1214.437	595.598	1216.963	595.631	1219.492	595.667	1222.024	595.708	1224.559	595.752	1227.097	595.800	1229.638	595.852	1232.183	595.908	900	
800	1069.150	529.331	1071.662	529.346	1074.178	529.365	1076.697	529.389	1079.219	529.417	1081.745	529.450	1084.274	529.487	1086.807	529.528	1089.343	529.573	1091.882	529.623	1094.425	529.677	1096.971	529.735	1099.521	529.798	800	
700	936.448	463.170	938.962	463.187	941.479	463.209	944.001	463.236	946.527	463.269	949.056	463.306	951.590	463.348	954.127	463.395	956.668	463.447	959.213	463.504	961.762	463.565	964.315	463.632	966.871	463.704	700	100 (P)*
600	803.747	397.010	806.263	397.030	808.783	397.056	811.309	397.087	813.838	397.123	816.373	397.168	818.912	397.217	821.455	397.272	824.003	397.333	826.555	397.399	829.112	397.471	831.674	397.549	834.240	397.633	600	
500	671.047	330.851	673.566	330.875	676.091	330.906	678.621	330.944	681.156	330.989	683.698	331.041	686.244	331.100	688.796	331.166	691.354	331.238	693.916	331.318	696.484	331.405	699.058	331.498	701.637	331.598	500	
480	538.349	264.695	540.873	264.725	543.403	264.764	545.941	264.812	548.486	264.868	551.037	264.933	553.595	265.006	556.160	265.089	558.731	265.179	561.309	265.279	563.894	265.387	566.486	265.504	569.084	265.629	480	
360	485.270	238.234	487.797	238.267	490.331	238.310	492.873	238.363	495.422	238.426	497.979	238.498	500.544	238.580	503.116	238.671	505.695	238.772	508.281	238.882	510.875	239.002	513.477	239.132	516.086	239.272	360	
350	472.001	231.618	474.528	231.653	477.063	231.698	479.606	231.752	482.157	231.816	484.716	231.890	487.282	231.974	489.856	232.068	492.438	232.172	495.027	232.286	497.623	232.409	500.227	232.542	502.839	232.686	350	
300	405.654	198.544	408.187	198.584	410.726	198.636	413.278	198.699	415.837	198.774	418.403	198.861	420.982	198.959	423.568	199.069	426.163	199.189	428.766	199.322	431.379	199.467	434.000	199.622	436.630	199.789	300	80 (P)*
250	339.310	165.472	341.849	165.521	344.398	165.583	346.956	165.659	349.529	165.749	352.111	165.853	354.703	165.970	357.305	166.102	359.919	166.247	362.542	166.406	365.177	166.579	367.821	166.766	370.476	166.966	250	
230	312.794	152.245	315.315	152.297	317.849	152.365	320.434	152.448	323.011	152.546	325.599	152.658	328.200	152.786	330.811	152.929	333.434	153.087	336.068	153.260	338.713	153.448	341.370	153.651	344.038	153.869	230	
200	272.971	132.406	275.519	132.466	278.080	132.544	280.655	132.639	283.243	132.752	285.844	132.882	288.459	133.029	291.086	133.193	293.727	133.374	296.381	133.573	299.047	133.789	301.726	134.022	304.418	134.273	200	65 (P)*
170	233.170	112.570	235.726	112.642	238.298	112.733	240.886	112.845	243.490	112.977	246.108	113.130	248.742	113.303	251.392	113.496	254.056	113.709	256.736	113.943	259.430	114.197	262.139	114.471	264.863	114.766	170	
155	213.271	102.655	215.833	102.733	218.412	102.833	221.008	102.956	223.621	103.101	226.251	103.268	228.898	103.458	231.561	103.670	234.241	103.904	236.937	104.160	239.649	104.438	242.377	104.739	245.121	105.061	155	
125	173.479	82.830	176.055	82.926	178.653	83.031	181.271	83.203	183.911	83.383	186.570	83.590	189.251	83.825	191.951	84.088	194.672	84.377	197.412	84.695	200.172	85.039	202.951	85.411	205.748	85.810	125	
100	140.327	66.320	142.922	66.441	145.543	66.596	148.190	66.787	150.863	67.011	153.561	67.270	156.284	67.563	159.032	67.891	161.803	68.253	164.599	68.648	167.418	69.078	170.259	69.542	173.124	70.039	100	
90	127.070	59.721	129.675	59.855	132.310	60.028	134.972	60.239	137.663	60.489	140.382	60.776	143.128	61.102	145.901	61.465	148.701	61.867	151.526	62.306	154.377	62.783	157.252	63.297	160.152	63.848	90	50 (P)*
80	113.817	53.126	116.435	53.257	119.085	53.422	121.767	53.709	124.481	53.989	127.225	54.313	130.000	54.679	132.804	55.087	135.638	55.538	138.499	56.031	141.389	56.566	144.305	57.143	147.248	57.761	80	50 (H)**
70	100.568	46.512	102.202	46.710	105.873	46.942	108.580	47.203	111.322	47.524	114.099	47.893	116.909	48.310	119.753	48.776	122.629	49.290	125.535	49.852	128.471	50.462	131.440	51.118	134.435	51.822	70	
60	87.326	39.958	89.982	40.159	92.680	40.418	95.419	40.735	98.199	41.108	101.017	41.537	103.874	42.023	106.768	42.565	109.698	43.163	112.662	43.816	115.660	44.523	118.691	45.284	121.752	46.099	60	40 (P)*
55	80.709	36.673	83.378	36.893	86.093	37.175	88.853	37.526	91.656	37.927	94.501	38.395	97.386	38.924	100.311	39.514	103.274	40.164	106.273	40.874	109.308	41.643	112.376	42.470	115.476	43.355	55	
50	74.095	33.393	76.781	33.615	79.516	33.945	82.299	34.324	85.130	34.771	88.005	35.285	90.924	35.866	93.885	36.513	96.887	37.226	99.926	38.003	103.002	38.845	106.113	39.749	109.257	40.716	50	40 (H)**
45	67.496	30.120	70.191	30.388	72.951	30.733	75.762	31.153	78.626	31.648	81.538	32.218	84.497	32.862	87.500	33.579	90.546	34.366	93.632	35.227	96.756	36.154	99.915	37.152	103.108	38.217	45	35 (P)**
40	60.884	26.852	63.613	27.154	66.412	27.544	69.250	28.016	72.152	28.571	75.108	29.210	78.114	29.931	81.168	30.735	84.266	31.614	87.406	32.573	90.584	33.608	93.798	34.719	97.046	35.902	40	35 (H) 30 (P)*
35	54.290	23.602	57.049	23.946	59.876	24.388	62.768	24.926	65.720	25.559	68.729	26.286	71.792	27.105	74.906	28.014	78.065	29.011	81.267	30.093	84.507	31.262	87.782	32.511	91.087	33.839	35	
33	51.656	22.405	54.430	22.671	57.275	23.079	60.187	23.608	63.162	24.239	66.196	25.147	69.285	26.013	72.426	26.973	75.613	28.026	78.842	29.166	82.109	30.397	85.408	31.711	88.737	33.106	33	
30	47.709	20.367	50.509	20.769	53.384	21.283	56.331	21.908	59.345	22.642	62.421	23.484	65.553	24.430	68.739	25.478	71.970	26.625	75.242	27.867	78.549	29.201	81.887	30.623	85.249	32.130	30	30 (H)**
25	41.150	17.162	44.003	17.642	46.843	18.256	49.663	19.002	52.457	19.875	55.217	20.872	57.943	21.990	60.631	23.222	63.278	24.566	65.883	26.013	68.447	27.560	70.966	29.200	73.440	30.925	25	
23	38.514	15.963	41.414	16.418	44.387	17.079	47.443	17.886	50.575	18.830	53.775	19.906	57.028	21.109	60.332	22.434	63.674	23.873	67.046	25.419	70.438	27.066	73.840	28.806			23	25 (P)*
20	33.625	14.009	37.554	14.605	40.595	15.366	43.703	16.287	46.899	17.359	50.161	18.578	53.476	19.934	56.832	21.420	60.217	23.025	63.616	24.740							20	25 (H)**
15	28.166	10.954	31.211	11.742	34.309	12.739	37.621	13.933	40.943	15.312	44.315	16.836	47.712	18.555													15	20 (P)*
14	26.897	10.364	29.962	11.208	33.111	12.264	36.435	13.536	39.783	14.994	43.174	16.623															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 106 Degrees

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=106°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3357.750	1654.273	3360.268	1654.297	3362.788	1654.324	3365.308	1654.348	3367.829	1654.375	3370.352	1654.402	3372.875	1654.434	3375.400	1654.465	3377.926	1654.496	3380.453	1654.531	3382.981	1654.566	3385.510	1654.602	3388.041	1654.641	2500	
2200	2959.636	1455.807	2962.177	1455.833	2964.698	1455.861	2967.222	1455.890	2969.746	1455.921	2972.272	1455.953	2974.799	1455.987	2977.327	1456.022	2979.856	1456.059	2982.387	1456.098	2984.918	1456.138	2987.452	1456.180	2989.986	1456.223	2200	
2000	2694.263	1323.500	2696.786	1323.529	2699.310	1323.559	2701.835	1323.591	2704.363	1323.625	2706.891	1323.660	2709.420	1323.698	2711.951	1323.736	2714.484	1323.777	2717.017	1323.819	2719.552	1323.864	2722.088	1323.909	2724.626	1323.957	2000	
1800	2428.874	1191.197	2431.400	1191.229	2433.926	1191.262	2436.455	1191.298	2438.984	1191.335	2441.515	1191.375	2444.048	1191.416	2446.583	1191.459	2449.118	1191.504	2451.656	1191.551	2454.194	1191.601	2456.735	1191.652	2459.277	1191.704	1800	
1500	2030.800	992.754	2033.330	992.792	2035.862	992.833	2038.396	992.875	2040.932	992.920	2043.469	992.968	2046.009	993.017	2048.550	993.069	2051.093	993.123	2053.638	993.180	2056.184	993.239	2058.732	993.300	2061.283	993.364	1500	
1200	1632.746	794.336	1635.284	794.384	1637.823	794.434	1640.365	794.488	1642.910	794.544	1645.457	794.603	1648.006	794.665	1650.557	794.730	1653.111	794.798	1655.667	794.868	1658.224	794.942	1660.785	795.019	1663.347	795.098	1200	
1000	1367.395	662.082	1369.941	662.139	1372.488	662.200	1375.039	662.264	1377.593	662.332	1380.148	662.402	1382.707	662.477	1385.268	662.555	1387.833	662.636	1390.399	662.721	1392.969	662.809	1395.541	662.901	1398.115	662.996	1000	
900	1234.730	595.968	1237.280	596.031	1239.833	596.098	1242.389	596.169	1244.948	596.244	1247.510	596.323	1250.076	596.406	1252.644	596.492	1255.215	596.583	1257.789	596.677	1260.366	596.775	1262.946	596.877	1265.529	596.983	900	
800	1102.074	529.865	1104.630	529.937	1107.190	530.012	1109.753	530.092	1112.319	530.177	1114.889	530.266	1117.462	530.358	1120.039	530.456	1122.619	530.557	1125.202	530.664	1127.788	530.773	1130.378	530.888	1132.971	531.007	800	
700	969.431	463.780	971.996	463.862	974.564	463.949	977.136	464.040	979.712	464.136	982.291	464.238	984.875	464.344	987.462	464.455	990.053	464.571	992.648	464.692	995.246	464.818	997.849	464.949	1000.455	465.085	700	
600	836.810	397.722	839.385	397.817	841.964	397.918	844.548	398.025	847.136	398.137	849.728	398.255	852.326	398.379	854.927	398.509	857.533	398.645	860.143	398.786	862.758	398.933	865.376	399.086	868.000	399.244	600	
500	704.221	331.706	706.810	331.820	709.405	331.941	712.005	332.069	714.611	332.204	717.221	332.346	719.837	332.494	722.458	332.650	725.085	332.813	727.716	332.982	730.353	333.158	732.995	333.342	735.642	333.531	500	
400	571.688	265.763	574.300	265.906	576.917	266.057	579.542	266.217	582.173	266.385	584.811	266.563	587.454	266.749	590.105	266.943	592.761	267.146	595.425	267.358	598.094	267.578	600.770	267.807	603.453	268.045	400	
360	518.702	239.420	521.325	239.579	523.956	239.747	526.594	239.925	529.238	240.112	531.891	240.309	534.550	240.515	537.216	240.731	539.890	240.957	542.570	241.192	545.258	241.437	547.952	241.691	550.654	241.954	360	100 (P)*
350	505.458	232.839	508.085	233.002	510.719	233.175	513.361	233.358	516.010	233.551	518.666	233.753	521.330	233.965	524.001	234.187	526.679	234.419	529.364	234.661	532.057	234.913	534.757	235.174	537.464	235.446	350	
300	439.268	199.968	441.913	200.158	444.571	200.359	447.236	200.573	449.908	200.797	452.589	201.033	455.279	201.281	457.977	201.540	460.683	201.810	463.398	202.092	466.121	202.385	468.852	202.690	471.592	203.007	300	
250	373.141	167.181	375.816	167.409	378.502	167.650	381.197	167.906	383.903	168.175	386.618	168.458	389.344	168.755	392.079	169.065	394.824	169.390	397.579	169.727	400.344	170.079	403.118	170.444	405.901	170.823	250	
230	346.717	154.102	349.406	154.349	352.107	154.612	354.819	154.890	357.542	155.182	360.274	155.490	363.018	155.812	365.773	156.149	368.538	156.501	371.313	156.868	374.099	157.250	376.895	157.646	379.701	158.058	230	80 (P)*
200	307.122	134.540	309.839	134.825	312.568	135.127	315.310	135.446	318.063	135.782	320.829	136.135	323.606	136.505	326.396	136.893	329.198	137.297	332.010	137.718	334.835	138.156	337.671	138.611	340.519	139.083	200	
170	267.601	115.080	270.354	115.415	273.121	115.769	275.901	116.144	278.696	116.539	281.505	116.954	284.327	117.388	287.163	117.843	290.012	118.317	292.875	118.812	295.750	119.326	298.639	119.859	301.540	120.413	170	
155	247.881	105.406	250.656	105.773	253.446	106.161	256.252	106.572	259.073	107.004	261.908	107.458	264.759	107.935	267.624	108.432	270.503	108.952	273.396	109.493	276.304	110.056	279.225	110.640	282.160	111.245	155	65 (P)*
125	208.565	86.237	211.400	86.690	214.253	87.171	217.124	87.678	220.013	88.212	222.920	88.773	225.843	89.361	228.783	89.975	231.740	90.615	234.714	91.282	237.703	91.976	240.708	92.695	243.729	93 440	125	
100	176.011	70.570	178.919	71.134	181.849	71.732	184.800	72.362	187.771	73.026	190.762	73.722	193.773	74.451	196.803	75.213	199.852	76.007	202.919	76.832	206.004	77.690	209.107	78 579	212.226	79.499	100	
90	163.076	64.436	166.024	65.061	168.994	65.723	171.986	66.422	175.000	67.156	178.036	67.926	181 092	68 733	184.168	69.574	187.264	70.451	190.378	71.363	193.512	72.309	196.663	73.289	199.831	74.304	90	50 (P)
80	150.217	58.421	153.210	59.121	156.229	59.863	159.271	60.644	162.336	61.466	165.423	62.327	168.532	63.228	171.661	64.168	174.811	65.146	177.980	66.163	181.168	67.217	184 374	68.309	187.597	69.437	80	50 (H)**
70	137.458	52.572	140.509	53.367	143.585	54.209	146.686	55.096	149.811	56.027	152.960	57.003	156.130	58.022	159.322	59.084	162.534	60.189	165.765	61.336	169.015	62.525	172.281	63.754	175.564	65.023	70	
60	124.843	46.967	127.962	47.888	131.108	48.860	134.281	49.882	137.478	50.956	140.698	52.078	143.940	53.249	147.202	54.468	150.484	55.734	153.783	57.045	157.099	58.402	160.429	59.803	163.773	61.247	60	40 (P)*
55	118.606	44.296	121.766	45.294	124.953	46 346	128.166	47.453	131.403	48.613	134 663	49.826	137.943	51.089	141.243	52.403	144.561	53.766	147.895	55.176	151.243	56.634	154.604	58 137	157.976	59.684	55	
50	112.432	41.744	115.636	42.832	118.867	43.979	122.123	45.184	125.403	46.445	128.704	47.761	132.024	49.131	135.362	50.554	138.715	52.027	142.081	53.550	145.458	55.120	148.845	56.738	152.239	58.399	50	40 (H)**
45	106.332	39.347	109.584	40.542	112.863	41.800	116.165	43.120	119.488	44.498	122.830	45.935	126.188	47.428	129.560	48.975	132.944	50.574	136.336	52.224	139.734	53.921	143.137	55.665	146.541	57.453	45	35 (P)*
40	100.322	37.156	103.626	38.479	106.953	39.869	110.300	41.323	113.665	42.840	117.043	44.416	120.433	46.050	123.830	47.739	127.233	49.480	130.637	51.271							40	30 (H)**
35	94.419	35.213	97.773	36.720	101 145	38.267	104.531	39.881	107.927	41.558	111.329	43.295															35	
33	92.090	34.578	95.462	36.125	98.848	37.743	102.245	39.428	105.648	41.175																	33	30 (P)*
30	88.629	33.716	92.023	35.378	95.425	37.110																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 107 Degrees

Δ = 107°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	3386.058	1702.934	3388.562	1702.941	3391.068	1702.945	3393.573	1702.953	3396.081	1702.965	3398.589	1702.973	3401.099	1702.988	3403.610	1703.000	3406.122	1703.012	3408.634	1703.031	3411.148	1703.047	3413.664	1703.066	3416.180	1703.086	2500	
2200	2980.633	1498.584	2983.137	1498.590	2985.643	1498.597	2988.150	1498.606	2990.658	1498.616	2993.168	1498.628	2995.679	1498.642	2998.191	1498.657	3000.704	1498.674	3003.219	1498.692	3005.735	1498.712	3008.252	1498.733	3010.771	1498.756	2200	
2000	2710.349	1362.351	2712.854	1362.357	2715.360	1362.365	2717.868	1362.375	2720.377	1362.386	2722.888	1362.399	2725.400	1362.414	2727.913	1362.430	2730.427	1362.449	2732.944	1362.469	2735.462	1362.491	2737.980	1362.514	2740.500	1362.540	2000	
1800	2440.063	1226.117	2442.571	1226.124	2445.078	1226.133	2447.586	1226.144	2450.097	1226.156	2452.609	1226.171	2455.122	1226.187	2457.636	1226.206	2460.153	1226.226	2462.671	1226.249	2465.190	1226.273	2467.711	1226.299	2470.234	1226.327	1800	
1500	2034.641	1021.768	2037.147	1021.776	2039.656	1021.786	2042.166	1021.799	2044.678	1021.814	2047.192	1021.832	2049.708	1021.852	2052.226	1021.874	2054.745	1021.898	2057.267	1021.925	2059.790	1021.955	2062.315	1021.986	2064.843	1022.020	1500	
1200	1629.216	817.419	1631.724	817.429	1634.235	817.442	1636.748	817.458	1639.263	817.477	1641.781	817.499	1644.300	817.524	1646.823	817.552	1649.347	817.582	1651.874	817.616	1654.403	817.652	1656.935	817.692	1659.468	817.734	1200	
1000	1358.934	681.187	1361.444	681.199	1363.957	681.215	1366.472	681.233	1368.990	681.257	1371.511	681.283	1374.035	681.313	1376.562	681.347	1379.091	681.383	1381.623	681.423	1384.158	681.467	1386.696	681.515	1389.236	681.565	1000	
900	1223.793	613.072	1226.304	613.085	1228.819	613.103	1231.335	613.125	1233.855	613.149	1236.379	613.179	1238.906	613.212	1241.435	613.249	1243.968	613.290	1246.503	613.335	1249.042	613.383	1251.584	613.436	1254.129	613.492	900	
800	1086.653	544.957	1089.165	544.972	1091.680	544.992	1094.200	545.016	1096.723	545.044	1099.250	545.077	1101.779	545.115	1104.312	545.156	1106.849	545.202	1109.389	545.252	1111.933	545.307	1114.480	545.366	1117.030	545.430	800	
750	953.513	476.843	956.027	476.860	958.545	476.882	961.067	476.910	963.593	476.943	966.123	476.980	968.657	477.023	971.195	477.070	973.737	477.123	976.283	477.180	978.832	477.243	981.386	477.311	983.944	477.383	750	100 (P)*
600	818.374	408.729	820.890	408.750	823.411	408.776	825.937	408.808	828.467	408.846	831.002	408.890	833.542	408.939	836.086	408.995	838.635	409.056	841.188	409.123	843.746	409.196	846.309	409.275	848.876	409.360	600	
500	683.256	340.617	685.756	340.642	688.281	340.673	690.812	340.712	693.348	340.757	695.890	340.810	698.437	340.869	700.990	340.936	703.549	341.009	706.113	341.090	708.682	341.177	711.257	341.272	713.837	341.374	500	
480	548.100	272.508	550.625	272.539	553.156	272.578	555.692	272.626	558.240	272.683	560.792	272.749	563.351	272.823	565.917	272.906	568.490	272.998	571.070	273.099	573.656	273.208	576.249	273.326	578.849	273.453	480	
360	494.047	245.266	496.574	245.300	499.109	245.343	501.652	245.397	504.202	245.460	506.760	245.533	509.325	245.616	511.899	245.708	514.479	245.810	517.068	245.922	519.663	246.043	522.267	246.175	524.878	246.316	360	
350	480.534	238.455	483.062	238.490	485.598	238.535	488.141	238.590	490.693	238.655	493.253	238.730	495.820	238.815	498.396	238.910	500.979	239.015	503.569	239.130	506.168	239.256	508.774	239.390	511.388	239.535	350	
300	412.869	204.904	415.501	204.945	418.043	204.998	420.594	205.062	423.155	205.137	425.724	204.725	428.302	204.824	430.890	204.935	433.486	205.057	436.092	205.192	438.707	205.338	441.330	205.495	443.962	205.664	300	80 (P)*
250	345.606	170.856	348.040	170.905	350.495	170.968	353.056	170.545	355.626	170.636	358.211	170.741	360.805	170.860	363.410	170.991	366.025	171.140	368.651	171.301	371.288	171.476	373.935	171.665	376.593	171.868	250	
230	316.382	156.730	320.924	156.791	323.479	156.860	326.045	156.944	328.623	157.042	331.213	157.156	333.815	157.286	336.429	157.430	339.054	157.590	341.691	157.765	344.339	157.955	346.999	158.161	349.669	158.381	230	
200	277.847	136.319	280.396	136.374	282.958	136.453	285.535	136.550	288.125	136.663	290.728	136.794	293.345	136.943	295.975	137.109	298.618	137.293	301.275	137.494	303.944	137.713	306.627	137.948	309.322	138.202	200	
170	237.316	115.892	239.873	115.964	242.446	116.027	245.036	116.170	247.641	116.304	250.262	116.458	252.899	116.633	255.551	116.828	258.219	117.044	260.903	117.281	263.600	117.538	266.313	117.815	269.041	118.113	170	65 (P)*
155	217.057	105.683	219.614	105.762	222.195	105.864	224.792	105.988	227.408	106.135	230.040	106.304	232.690	106.496	235.356	106.710	238.039	106.947	240.739	107.206	243.455	107.488	246.188	107.792	248.936	108.118	155	
125	176.328	85.273	179.106	85.371	181.705	85.497	184.326	85.651	186.968	85.832	189.631	86.042	192.315	86.280	195.019	86.545	197.744	86.839	200.489	87.160	203.253	87.508	206.038	87.885	208.841	88.289	125	
100	142.767	68.275	145.364	68.397	147.987	68.555	150.637	68.747	153.312	68.974	156.015	69.236	158.742	69.533	161.495	69.864	164.272	70.230	167.073	70.631	169.898	71.066	172.747	71.535	175.619	72.038	100	50 (P)*
90	129.267	61.480	131.874	61.617	134.511	61.792	137.177	62.005	139.871	62.258	142.594	62.549	145.345	62.878	148.124	63.246	150.929	63.652	153.761	64.096	156.618	64.579	159.501	65.099	162.410	65.656	90	
80	115.770	54.691	118.390	54.844	121.043	55.040	123.729	55.281	126.447	55.564	129.196	55.892	131.976	56.262	134.786	56.673	137.626	57.131	140.495	57.640	143.392	58.171	146.317	58.755	149.269	59.381	80	50 (H)**
70	102.278	47.907	104.914	48.082	107.588	48.307	110.299	48.581	113.046	48.905	115.829	49.278	118.645	49.701	121.495	50.172	124.379	50.692	127.294	51.265	130.240	51.878	133.216	52.542	136.222	53.254	70	
60	86.792	41.133	91.451	41.337	94.152	41.599	96.897	41.919	99.682	42.296	102.507	42.731	105.371	43.223	108.273	43.771	111.212	44.376	114.186	45.036	117.194	45.752	120.235	46.522	123.308	47.346	60	40 (P)*
55	82.054	37.761	84.726	37.972	87.445	38.259	90.210	38.608	93.019	39.019	95.871	39.493	98.764	40.028	101.698	40.625	104.670	41.283	107.680	42.001	110.726	42.779	113.806	43.616	116.919	44.511	55	
50	75.319	34.336	78.008	34.618	80.747	34.932	83.536	35.315	86.373	35.767	89.257	36.287	92.184	36.875	95.155	37.530	98.166	38.251	101.217	39.038	104.306	39.889	107.430	40.804	110.588	41.783	50	40 (H)**
45	68.588	31.003	71.297	31.274	74.062	31.623	76.880	32.048	79.751	32.549	82.671	33.126	85.639	33.777	88.653	34.502	91.710	35.299	94.809	36.168	97.946	37.108	101.121	38.118	104.329	39.195	45	35 (P)*
40	61.864	27.640	64.598	27.946	67.392	28.338	70.247	28.815	73.162	29.377	76.124	30.024	79.140	30.753	82.205	31.564	85.316	32.456	88.470	33.426	91.664	34.474	94.895	35.597	98.159	36.794	40	35 (H) 30 (P)*
35	55.150	24.291	57.914	24.638	60.748	25.086	63.647	25.630	66.608	26.271	69.628	27.006	72.704	27.835	75.830	28.754	79.004	29.763	82.222	30.860	85.479	32.041	88.773	33.305	92.097	34.648	35	
33	52.467	22.955	55.249	23.325	58.098	23.799	61.019	24.375	64.004	25.053	67.049	25.831	70.151	26.706	73.306	27.678	76.508	28.743	79.754	29.896	83.039	31.143	86.358	32.472	89.707	33.883	33	
30	48.448	20.959	51.254	21.365	54.137	21.885	57.093	22.518	60.118	23.264	63.206	24.132	66.353	25.070	69.553	26.130	72.801	27.290	76.091	28.547	79.418	29.897	82.776	31.336	86.160	32.860	30	30 (H)**
25	41.788	17.840	44.628	18.144	47.537	18.765	50.609	19.514	53.745	20.402	56.689	21.411	60.123	22.542	63.409	23.789	66.719	25.148	70.106	26.613	73.560	28.176	76.915	29.837	80.341	31.582	25	
23	39.105	16.350	41.993	16.877	44.975	17.550	48.043	18.367	51.168	19.322	54.402	20.410	57.675	21.628	60.999	22.968	64.362	24.423	67.757	25.988	71.172	27.655	74.600	29.415			23	25 (P)*
20	35.124	14.408	38.092	15.012	41.103	15.782	44.235	16.713	47.447	17.798	50.727	19.031	54.062	20.404	57.440	21.907	60.848	23.531	64.273	25.266							20	23 (H)**
15	28.546	11.259	31.603	12.056	34.776	13.065	38.045	14.274	41.388	15.668	44.782	17.233	48.205	18.949													15	20 (P)*
14	27.244	10.651	30.332	11.502	33.538	12.576	36.839	13.859	40.208	15.335	43.630	16.983															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 107 Degrees

△=107°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3418.697	1703.109	3421.216	1703.133	3423.735	1703.156	3426.256	1703.180	3428.778	1703.207	3431.301	1703.238	3433.825	1703.266	3436.350	1703.301	3438.876	1703.332	3441.404	1703.367	3443.933	1703.402	3446.462	1703.438	3448.993	1703.477	2500	
2200	3013.290	1498.781	3015.811	1498.807	3018.333	1498.835	3020.857	1498.865	3023.382	1498.896	3025.908	1498.928	3028.436	1498.962	3030.964	1498.998	3033.494	1499.036	3036.025	1499.074	3038.558	1499.115	3041.091	1499.157	3043.626	1499.201	2200	
2000	2743.022	1362.567	2745.546	1362.596	2748.070	1362.626	2750.596	1362.659	2753.123	1362.693	2755.652	1362.729	2758.182	1362.767	2760.713	1362.806	2763.247	1362.847	2765.781	1362.890	2768.316	1362.935	2770.853	1362.981	2773.391	1363.029	2000	
1800	2472.758	1226.358	2475.284	1226.390	2477.811	1226.424	2480.340	1226.460	2482.870	1226.498	2485.402	1226.537	2487.935	1226.579	2490.470	1226.623	2493.007	1226.669	2495.545	1226.716	2498.084	1226.766	2500.625	1226.818	2503.168	1226.871	1800	
1500	2067.371	1022.056	2069.902	1022.094	2072.435	1022.135	2074.969	1022.179	2077.506	1022.224	2080.043	1022.272	2082.584	1022.322	2085.126	1022.375	2087.669	1022.429	2090.215	1022.487	2092.762	1022.546	2095.311	1022.608	2097.863	1022.672	1500	
1200	1662.004	817.779	1664.543	817.828	1667.083	817.878	1669.626	817.932	1672.172	817.989	1674.719	818.049	1677.270	818.112	1679.822	818.178	1682.376	818.246	1684.933	818.318	1687.492	818.392	1690.054	818.469	1692.617	818.550	1200	
1000	1391.780	681.620	1394.326	681.677	1396.875	681.739	1399.426	681.803	1401.980	681.872	1404.537	681.943	1407.097	682.019	1409.660	682.098	1412.225	682.180	1414.793	682.266	1417.364	682.355	1419.937	682.448	1422.513	682.544	1000	
900	1256.677	613.552	1259.228	613.617	1261.782	613.685	1264.339	613.757	1266.900	613.833	1269.463	613.912	1272.029	613.996	1274.599	614.083	1277.171	614.175	1279.747	614.270	1282.325	614.369	1284.906	614.472	1287.491	614.580	900	
800	1121.584	545.497	1124.142	545.570	1126.703	545.646	1129.267	545.727	1131.834	545.813	1134.406	545.903	1136.980	545.997	1139.558	546.095	1142.139	546.198	1144.724	546.305	1147.312	546.416	1149.903	546.532	1152.498	546.653	800	
700	986.505	477.460	989.071	477.543	991.640	477.631	994.213	477.723	996.791	477.821	999.372	477.923	1001.957	478.030	1004.546	478.143	1007.138	478.261	1009.735	478.383	1012.335	478.510	1014.939	478.643	1017.548	478.781	700	
600	851.448	409.450	854.024	409.546	856.604	409.648	859.190	409.756	861.780	409.870	864.374	409.990	866.973	410.115	869.576	410.247	872.184	410.384	874.796	410.526	877.413	410.675	880.034	410.830	882.659	410.990	600	
500	716.423	341.482	719.014	341.597	721.610	341.720	724.213	341.850	726.820	341.986	729.433	342.130	732.051	342.280	734.674	342.438	737.303	342.602	739.937	342.773	742.576	342.952	745.221	343.137	747.871	343.330	500	
400	581.456	273.589	584.069	273.733	586.689	273.886	589.316	274.048	591.949	274.219	594.590	274.398	597.236	274.586	599.889	274.783	602.549	274.988	605.216	275.203	607.888	275.425	610.568	275.657	613.254	275.897	400	
360	527.496	246.467	530.121	246.627	532.755	246.797	535.395	246.977	538.042	247.166	540.698	247.365	543.360	247.574	546.030	247.793	548.707	248.021	551.390	248.259	554.082	248.507	556.780	248.763	559.485	249.030	360	100 (P)*
350	514.009	239.690	516.638	239.855	519.275	240.030	521.919	240.215	524.571	240.410	527.230	240.615	529.897	240.830	532.572	241.054	535.253	241.289	537.942	241.533	540.638	241.788	543.342	242.053	546.053	242.327	350	
300	446.603	205.845	449.253	206.037	451.912	206.241	454.579	206.457	457.255	206.684	459.940	206.923	462.633	207.173	465.335	207.436	468.045	207.709	470.764	207.994	473.492	208.291	476.227	208.599	478.971	208.919	300	
250	379.261	172.084	381.940	172.315	384.629	172.560	387.328	172.818	390.038	173.091	392.758	173.377	395.487	173.677	398.227	173.991	400.977	174.319	403.737	174.661	406.506	175.017	409.286	175.386	412.075	175.769	250	
230	352.352	158.616	355.045	158.867	357.750	159.133	360.466	159.414	363.192	159.710	365.930	160.021	368.678	160.347	371.438	160.688	374.208	161.044	376.989	161.416	379.780	161.802	382.582	162.203	385.394	162.619	230	80 (P)*
200	312.030	138.473	314.751	138.761	317.485	139.066	320.231	139.389	322.990	139.729	325.760	140.086	328.543	140.461	331.339	140.853	334.146	141.262	336.965	141.688	339.796	142.131	342.639	142.592	345.494	143.069	200	
170	271.784	118.431	274.541	118.770	277.313	119.128	280.099	119.508	282.900	119.907	285.715	120.327	288.543	120.766	291.386	121.226	294.242	121.708	297.112	122.207	299.995	122.727	302.891	123.267	305.801	123.827	170	
155	251.701	108.467	254.482	108.838	257.278	109.231	260.090	109.646	262.917	110.084	265.759	110.544	268.616	111.025	271.489	111.529	274.375	112.055	277.277	112.602	280.192	113.171	283.122	113.762	286.066	114.375	155	65 (P)*
125	211.664	88.720	214.506	89.179	217.366	89.665	220.245	90.178	223.141	90.718	226.056	91.286	228.988	91.880	231.937	92.502	234.904	93.150	237.887	93.825	240.886	94.526	243.902	95.254	246.933	96.008	125	
100	178.513	72.575	181.430	73.146	184.368	73.750	187.328	74.388	190.309	75.060	193.311	75.764	196.332	76.502	199.374	77.272	202.434	78.075	205.514	78.911	208.611	79.778	211.727	80.678	214.860	81.609	100	
90	165.342	66.252	168.299	66.884	171.278	67.554	174.281	68.260	177.306	69.003	180.353	69.783	183.421	70.598	186.509	71.450	189.618	72.337	192.746	73.259	195.893	74.217	199.058	75.209	202.241	76.235	90	50 (P)
80	152.247	60.048	155.251	60.757	158.281	61.507	161.334	62.297	164.411	63.129	167.511	64.000	170.633	64.912	173.776	65.862	176.941	66.852	180.125	67.881	183.328	68.947	186.550	70.052	189.789	71.194	80	50 (H)**
70	139.257	54.012	142.319	54.818	145.407	55.669	148.521	56.566	151.660	57.509	154.823	58.496	158.009	59.527	161.216	60.602	164.444	61.720	167.692	62.880	170.959	64.082	174.244	65.326	177.545	66.610	70	
60	126.412	48.225	129.545	49.156	132.705	50.139	135.893	51.174	139.105	52.260	142.342	53.395	145.601	54.580	148.881	55.814	152.182	57.094	155.500	58.421	158.836	59.794	162.187	61.211	165.552	62.672	60	40 (P)*
55	120.063	45.463	123.237	46.473	126.440	47.538	129.669	48.657	132.923	49.831	136.201	51.058	139.500	52.336	142.819	53.666	146.157	55.044	149.511	56.472	152.881	57.946	156.264	59.467	159.659	61.032	55	
50	113.778	42.823	116.998	43.923	120.246	45.084	123.520	46.303	126.818	47.578	130.138	48.910	133.479	50.296	136.837	51.736	140.212	53.226	143.600	54.767	147.001	56.356	150.411	57.982	153.829	59.673	50	40 (H)**
45	107.569	40.339	110.839	41.548	114.136	42.821	117.458	44.155	120.801	45.550	124.164	47.004	127.544	48.514	130.939	50.080	134.346	51.698	137.762	53.366	141.186	55.084	144.614	56.848	148.044	58.657	45	35 (P)*
40	101.454	38.063	104.777	39.401	108.125	40.806	111.493	42.229	114.880	43.814	118.282	45.409	121.695	47.062	125.118	48.770	128.546	50.532	131.976	52.343							40	30 (H)**
35	95.449	36.069	98.825	37.563	102.220	39.128	105.629	40.761	109.050	42.458	112.477	44.215															35	
33	93.081	35.373	96.476	36.938	99.886	38.575	103.308	40.279	106.736	42.047																	33	30 (P)*
30	89.564	34.465	92.982	36.146	96.409	37.899																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 108 Degrees

△=108°

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h		
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre			
2500	3448.455	1753.258	3450.959	1753.262	3453.464	1753.270	3455.970	1753.277	3458.478	1753.285	3460.987	1753.297	3463.496	1753.309	3466.007	1753.324	3468.520	1753.336	3471.032	1753.355	3473.546	1753.371	3478.579	1753.470	2500			
2200	3035.542	1542.868	3038.046	1542.874	3040.552	1542.881	3043.060	1542.890	3045.568	1542.901	3048.078	1542.913	3050.589	1542.927	3053.101	1542.942	3055.615	1542.959	3058.129	1542.977	3060.646	1542.998	3065.682	1543.042	2200			
2000	2760.266	1402.609	2762.771	1402.615	2765.278	1402.623	2767.786	1402.633	2770.295	1402.645	2772.806	1402.658	2775.318	1402.673	2777.832	1402.690	2780.346	1402.708	2782.863	1402.729	2785.381	1402.751	2790.421	1402.801	2000			
1800	2484.991	1262.350	2487.497	1262.357	2490.004	1262.366	2492.512	1262.376	2495.023	1262.389	2497.535	1262.404	2500.048	1262.421	2502.563	1262.439	2505.080	1262.460	2507.598	1262.483	2510.118	1262.508	2512.640	1262.534	2515.163	1262.563	1800	
1500	2072.079	1051.962	2074.585	1051.970	2077.094	1051.980	2079.604	1051.993	2082.117	1052.009	2084.631	1052.027	2087.147	1052.046	2089.665	1052.069	2092.185	1052.094	2094.707	1052.121	2097.231	1052.151	2099.757	1052.183	2102.284	1052.217	1500	
1200	1659.167	841.574	1661.675	841.584	1664.186	841.598	1666.699	841.614	1669.214	841.633	1671.732	841.656	1674.252	841.680	1676.775	841.708	1679.300	841.739	1681.827	841.773	1684.357	841.810	1686.889	841.850	1689.424	841.893	1200	
1000	1383.893	701.316	1386.403	701.329	1388.916	701.345	1391.432	701.365	1393.950	701.387	1396.471	701.414	1398.996	701.444	1401.523	701.478	1404.053	701.515	1406.585	701.556	1409.121	701.600	1411.659	701.648	1414.201	701.699	1000	
900	1246.256	631.188	1248.768	631.202	1251.282	631.220	1253.799	631.242	1256.320	631.267	1258.844	631.296	1261.371	631.330	1263.901	631.367	1266.434	631.409	1268.970	631.454	1271.510	631.503	1274.052	631.556	1276.598	631.614	900	
800	1108.620	561.061	1111.133	561.076	1113.649	561.096	1116.168	561.120	1118.691	561.149	1121.218	561.182	1123.749	561.220	1126.282	561.262	1128.820	561.308	1131.361	561.359	1133.905	561.415	1136.453	561.475	1139.005	561.539	800	
700	970.984	490.933	973.499	490.951	976.017	490.974	978.539	491.001	981.066	491.035	983.596	491.073	986.131	491.116	988.670	491.163	991.212	491.217	993.759	491.275	996.310	491.338	998.865	491.407	1001.423	491.480	700	100 (P)*
600	833.349	420.807	835.866	420.828	838.387	420.854	840.914	420.887	843.444	420.925	845.980	420.969	848.521	421.020	851.065	421.076	853.615	421.138	856.170	421.206	858.729	421.280	861.292	421.359	863.861	421.445	600	
500	695.716	350.682	698.236	350.707	700.761	350.739	703.293	350.778	705.830	350.824	708.373	350.877	710.921	350.937	713.474	351.005	716.034	351.079	718.599	351.161	721.170	351.249	723.746	351.345	726.328	351.448	500	
400	558.084	280.560	560.609	280.591	563.141	280.631	565.680	280.680	568.227	280.738	570.780	280.804	573.340	280.879	575.907	280.963	578.481	281.056	581.062	281.158	583.650	281.269	586.245	281.388	588.847	281.517	400	
360	503.033	252.513	505.560	252.547	508.096	252.591	510.639	252.646	513.191	252.709	515.750	252.783	518.316	252.867	520.891	252.960	523.473	253.064	526.063	253.177	528.661	253.300	531.266	253.433	533.879	253.576	360	
325	489.270	245.501	491.798	245.536	494.335	245.582	496.880	245.637	499.432	245.703	501.993	245.779	504.562	245.865	507.138	245.961	509.723	246.068	512.315	246.184	514.916	246.311	517.524	246.447	520.140	246.594	325	80 (P)*
300	420.457	210.443	422.990	210.485	425.533	210.538	428.085	210.603	430.646	210.680	433.217	210.768	435.797	210.869	438.386	210.981	440.984	211.104	443.592	211.240	446.209	211.388	448.834	211.547	451.469	211.719	300	
250	351.646	175.389	354.186	175.438	356.737	175.502	359.300	175.580	361.873	175.672	364.458	175.779	367.053	175.899	369.660	176.034	372.278	176.183	374.906	176.345	377.545	176.522	380.195	176.714	382.856	176.919	250	
230	324.123	161.568	326.667	161.622	329.222	161.692	331.790	161.776	334.369	161.877	336.961	161.992	339.565	161.923	342.181	162.069	344.808	162.231	347.448	162.408	350.098	162.600	352.761	162.808	355.435	163.031	230	
200	282.840	140.340	285.390	140.402	287.953	140.482	290.531	140.579	293.123	140.694	295.728	140.827	298.347	140.978	300.979	141.146	303.625	141.332	306.285	141.535	308.958	141.756	311.644	141.995	314.343	142.251	200	
170	241.560	119.315	244.118	119.388	246.693	119.482	249.284	119.596	251.891	119.732	254.515	119.888	257.154	120.065	259.809	120.263	262.480	120.481	265.167	120.721	267.868	120.980	270.586	121.261	273.318	121.562	170	65 (P)*
155	220.922	108.804	223.485	108.885	226.067	108.987	228.667	109.113	231.285	109.261	233.919	109.433	236.572	109.627	239.241	109.844	241.928	110.083	244.632	110.346	247.352	110.631	250.089	110.938	252.843	111.269	155	
125	179.659	87.799	182.229	87.889	184.830	88.017	187.453	88.173	190.098	88.357	192.764	88.569	195.451	88.810	198.160	89.078	200.889	89.375	203.638	89.700	206.408	90.052	209.198	90.434	212.008	90.842	125	
100	145.266	70.290	147.864	70.414	150.490	70.573	153.142	70.768	155.822	70.997	158.528	71.263	161.259	71.563	164.017	71.898	166.799	72.269	169.606	72.674	172.438	73.114	175.293	73.588	178.173	74.098	100	
90	131.516	63.294	134.125	63.432	136.764	63.609	139.433	63.825	142.132	64.081	144.859	64.375	147.615	64.709	150.399	65.081	153.210	65.492	156.048	65.941	158.913	66.429	161.804*	66.956	164.720	67.520	90	50 (P)*
80	117.769	56.303	120.392	56.458	123.048	56.652	125.737	56.901	128.459	57.188	131.213	57.519	133.999	57.893	136.815	58.312	139.662	58.773	142.538	59.278	145.443	59.826	148.377	60.416	151.338	61.049	80	50 (H)*
70	104.028	49.319	106.667	49.496	109.345	49.723	112.060	50.001	114.812	50.329	117.599	50.707	120.422	51.134	123.280	51.611	126.170	52.138	129.094	52.713	132.049	53.337	135.036	54.009	138.052	54.729	70	
60	90.294	42.344	92.935	42.550	95.661	42.815	98.410	43.139	101.201	43.521	104.032	43.961	106.904	44.459	109.814	45.013	112.761	45.625	115.745	46.294	118.764	47.018	121.817	47.797	124.902	48.632	60	40 (P)*
55	83.431	38.861	86.106	39.086	88.830	39.376	91.600	39.728	94.415	40.145	97.274	40.624	100.175	41.166	103.117	41.770	106.100	42.436	109.120	43.162	112.177	43.950	115.270	44.796	118.396	45.702	55	
50	76.571	35.384	79.264	35.631	82.008	35.949	84.803	36.337	87.647	36.794	90.538	37.321	93.474	37.918	96.454	38.578	99.476	39.308	102.539	40.104	105.640	40.965	108.778	41.892	111.950	42.882	50	40 (H)**
45	69.212	31.913	71.910	32.168	74.650	32.540	77.429	32.921	80.902	33.476	83.831	34.061	86.809	34.720	89.833	35.454	92.902	36.261	96.014	37.147	99.165	38.091	102.355	39.113	105.579	40.203	45	35 (P)*
40	62.869	28.450	65.607	28.759	68.404	29.156	71.269	29.639	74.188	30.208	77.163	30.862	80.191	31.600	83.268	32.421	86.392	33.323	89.560	34.305	92.770	35.365	96.017	36.502	99.299	37.713	40	35 (H) 30 (P)*
35	56.030	25.000	58.800	25.353	61.640	25.806	64.547	26.356	67.518	27.005	70.549	27.749	73.636	28.587	76.777	29.518	79.966	30.539	83.200	31.648	86.475	32.844	89.787	34.123	93.131	35.482	35	
33	53.298	23.625	56.083	23.999	58.942	24.479	61.870	25.062	64.865	25.748	67.923	26.535	71.038	27.421	74.206	28.404	77.425	29.482	80.688	30.652	83.991	31.914	87.330	33.256	90.700	34.684	33	
30	49.205	21.569	52.016	21.980	54.907	22.507	57.872	23.147	60.908	23.899	64.009	24.760	67.170	25.729	70.386	26.802	73.651	27.976	76.960	29.248	80.307	30.614	83.687	32.070	87.093	33.613	30	30 (H)**
25	42.402	18.168	45.269	18.660	48.227	19.289	51.270	20.052	54.389	20.946	57.578	21.967	60.829	23.111	64.133	24.373	67.484	25.749	70.872	27.231	74.290	28.815	77.729	30.493	81.181	32.266	25	
23	39.689	16.821	42.583	17.354	45.577	18.036	48.657	18.862	51.816	19.828	55.047	20.930	58.338	22.162	61.681	23.518	65.066	24.991	68.484	26.575	71.924	28.261*	75.378	30.043			23	25 (P)*
20	35.635	14.820	38.582	15.431	41.624	16.211	44.780	17.153	48.008	18.251	51.307	19.499	54.662	20.888	58.062	22.409	61.494	24.052	64.945	25.808							20	25 (H)**
15	28.936	11.573	32.005	12.380	35.193	13.401	38.480	14.624	41.843	16.035	45.260	17.618	48.709	19.356													15	20 (P)*
14	27.610	10.946	30.711	11.807	33.933	12.894	37.253	14.193	40.644	15.686	44.080	17.354															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 108 Degrees

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=108°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	3481.096	1753.434	3483.615	1753.457	3486.135	1753.480	3488.656	1753.508	3491.179	1753.535	3493.702	1753.562	3496.227	1753.594	3498.752	1753.625	3501.279	1753.660	3503.807	1753.695	3506.336	1753.730	3508.866	1753.770	3511.398	1753.809	2500	
2200	3068.202	1543.067	3070.724	1543.094	3073.246	1543.122	3075.771	1543.152	3078.296	1543.184	3080.822	1543.217	3083.350	1543.251	3085.879	1543.288	3088.410	1543.325	3090.941	1543.365	3093.475	1543.406	3096.009	1543.449	3098.544	1543.493	2200	
2000	2792.943	1402.828	2795.467	1402.857	2797.991	1402.888	2800.518	1402.921	2803.046	1402.956	2805.575	1402.992	2808.105	1403.030	2810.637	1403.070	2813.171	1403.112	2815.706	1403.155	2818.242	1403.200	2820.780	1403.247	2823.319	1403.296	2000	
1800	2517.687	1262.593	2520.213	1262.626	2522.741	1262.660	2525.271	1262.697	2527.801	1262.735	2530.334	1262.775	2532.868	1262.818	2535.403	1262.862	2537.940	1262.908	2540.479	1262.956	2543.019	1263.007	2545.562	1263.059	2548.105	1263.113	1800	
1500	2104.814	1052.253	2107.345	1052.292	2109.879	1052.334	2112.414	1052.377	2114.950	1052.424	2117.489	1052.472	2120.030	1052.523	2122.573	1052.576	2125.117	1052.631	2127.664	1052.689	2130.212	1052.750	2132.762	1052.812	2135.314	1052.877	1500	
1200	1691.960	841.939	1694.500	841.988	1697.041	842.039	1699.585	842.094	1702.131	842.151	1704.679	842.212	1707.230	842.276	1709.784	842.342	1712.339	842.411	1714.897	842.484	1717.457	842.559	1720.020	842.637	1722.585	842.718	1200	
1000	1416.745	701.754	1419.292	701.813	1421.842	701.875	1424.394	701.940	1426.949	702.010	1429.507	702.082	1432.068	702.158	1434.632	702.238	1437.198	702.321	1439.768	702.408	1442.340	702.499	1444.915	702.592	1447.492	702.689	1000	
900	1279.147	631.675	1281.699	631.740	1284.254	631.809	1286.812	631.881	1289.374	631.958	1291.938	632.039	1294.506	632.123	1297.077	632.212	1299.651	632.304	1302.227	632.401	1304.807	632.501	1307.390	632.606	1309.977	632.714	900	
800	1141.559	561.607	1144.118	561.681	1146.680	561.758	1149.245	561.840	1151.814	561.927	1154.387	562.017	1156.963	562.113	1159.542	562.212	1162.125	562.316	1164.711	562.425	1167.301	562.537	1169.894	562.655	1172.491	562.777	800	
700	1003.986	491.558	1006.552	491.642	1009.124	491.731	1011.698	491.824	1014.277	491.923	1016.859	492.027	1019.446	492.135	1022.036	492.250	1024.631	492.368	1027.229	492.492	1029.832	492.621	1032.438	492.755	1035.048	492.895	700	
600	866.434	421.536	869.011	421.634	871.594	421.737	874.181	421.847	876.772	421.962	879.368	422.083	881.969	422.210	884.574	422.343	887.184	422.481	889.798	422.626	892.417	422.776	895.041	422.933	897.669	423.095	600	
500	728.915	351.557	731.568	351.674	734.106	351.798	736.711	351.930	739.320	352.068	741.935	352.213	744.555	352.365	747.181	352.524	749.812	352.691	752.448	352.864	755.091	353.045	757.738	353.233	760.391	353.427	500	
400	591.456	281.654	594.072	281.800	596.694	281.955	599.323	282.119	601.959	282.291	604.602	282.473	607.251	282.663	609.907	282.863	612.570	283.070	615.240	283.287	617.916	283.512	620.598	283.747	623.288	283.990	400	
360	536.500	253.728	539.127	253.890	541.763	254.062	544.406	254.244	547.056	254.436	549.715	254.638	552.380	254.849	555.053	255.070	557.733	255.301	560.420	255.542	563.115	255.792	565.817	256.052	568.527	256.322	360	100 (P)*
350	522.764	246.751	525.396	246.918	528.035	247.095	530.682	247.282	533.336	247.479	535.959	247.687	538.669	247.904	541.346	248.131	544.031	248.368	546.724	248.616	549.424	248.874	552.132	249.142	554.847	249.419	350	
300	454.113	211.902	456.766	212.096	459.427	212.302	462.098	212.521	464.778	212.751	467.466	212.992	470.163	213.246	472.869	213.511	475.583	213.788	478.306	214.076	481.038	214.377	483.778	214.689	486.527	215.013	300	
250	385.528	177.138	388.210	177.372	390.902	177.619	393.605	177.881	396.319	178.156	399.043	178.446	401.777	178.750	404.522	179.068	407.277	179.400	410.042	179.746	412.816	180.106	415.601	180.479	418.396	180.867	250	
230	358.121	163.270	360.818	163.523	363.527	163.792	366.247	164.076	368.978	164.376	371.720	164.691	374.474	165.021	377.238	165.366	380.013	165.727	382.800	166.102	385.597	166.493	388.404	166.899	391.223	167.320	230	80 (P)*
200	317.055	142.525	319.781	142.817	322.519	143.126	325.270	143.452	328.033	143.797	330.809	144.158	333.598	144.537	336.399	144.934	339.212	145.348	342.038	145.779	344.875	146.228	347.725	146.694	350.587	147.177	200	
170	276.066	121 885	278.828	122.227	281.605	122.590	284.397	122.974	287.204	123.378	290.025	123.803	292.860	124.248	295.709	124.713	298.573	125.199	301.450	125.705	304.341	126.231	307.245	126.778	310.163	127.345	170	
155	255.613	111.622	258.399	111.997	261.201	112.395	264.019	112.815	266.852	113.258	269.701	113.723	272.566	114.211	275.445	114.720	278.340	115.252	281.250	115.806	284.174	116.382	287.112	116.980	290.065	117.600	155	65 (P)*
125	214.837	91.279	217.685	91 743	220.553	92.235	223.439	92.754	226.344	93.301	229.267	93.876	232.208	94.477	235.166	95.106	238.142	95.762	241.135	96.445	244.145	97.155	247.172	97.891	250.214	98.654	125	
100	181.075	74.641	184.000	75.219	186.948	75.831	189.917	76.476	192.908	77.156	195.920	77.869	198.953	78.615	202.006	79.395	205.078	80.208	208.170	81.053	211.280	81.931	214.409	82.841	217.556	83.783	100	
90	167.662	68.123	170.628	68.763	173.617	69.440	176.631	70.155	179.667	70.907	182.725	71.696	185.805	72.521	188.906	73.383	192.028	74.281	195.170	75.214	198.331	76.183	201.511	77.187	204.709	78.225	90	50 (P)
80	154.327	61.775	157.341	62.442	160.381	63.201	163.447	64.001	166.536	64.842	169.649	65.724	172.784	66.647	175.942	67.609	179.121	68.611	182.320	69.651	185.539	70.731	188.778	71.849	192.034	73.004	80	50 (H)**
70	141.098	55.497	144.172	56.312	147.273	57.174	150.400	58.082	153.553	59.035	156.731	60.034	159.931	61.078	163.155	62.166	166.400	63.297	169.665	64.471	172.950	65.688	176.253	66.946	179.573	68.246	70	
60	128.019	49.520	131.165	50.463	134.341	51.458	137.543	52.505	140.772	53.604	144.025	54.753	147.302	55.952	150 601	57.200	153.920	58-96	157.258	59.839	160.614	61.228	163.986	62.663	167.373	64.141	60	40 (P) *
55	121.555	46.666	124.744	47.688	127.962	48.765	131.208	49.899	134.479	51.086	137.775	52.328	141.093	53.621	144.432	54.967	147.791	56.362	151.166	57.806	154.558	59.298	157.963	60.837	161.381	62.421	55	
50	115.156	43.934	118.392	45.048	121.657	46.222	124.950	47.456	128.267	48.747	131 607	50.094	134.968	51.497	138.347	52.954	141.744	54.462	145.155	56.021	148.579	57.630	152.014	59.285	155.458	60.987	50	40 (H)**
45	108.836	41.361	112.124	42.584	115.440	43.872	118.781	45.223	122.145	46.635	125.530	48.106	128.933	49.634	132.351	51.218	135.781	52.855	139.223	54.544	142.671	56.282	146.126	58.068	149.583	59.898	45	35 (P)*
40	102.613	38.997	105.956	40.352	109.324	41.775	112.715	43.264	116.124	44.817	119.550	46.431	122.988	48.104	126.436	49.833	129.890	51.616	133.347	53.449							40	30 (H)**
35	96.504	36.920	99.902	38.432	103.320	40.016	106.754	41.668	110.200	43.385	113.653	45.164															35	
33	94.096	36.191	97.514	37.775	100.949	39.432	104.396	41.156	107.850	42.946																	33	30 (P)*
30	90.521	35.237	93.964	36.938	97.417	38.712																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 109 Degrees

Δ = 109°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	3512.370	1805.129	3514.875	1805.137	3517.380	1805.141	3519.886	1805.148	3522.394	1805.160	3524.903	1805.172	3527.412	1805.184	3529.924	1805.195	3532.436	1805.211	3534.949	1805.227	3537.463	1805.246	3539.979	1805.266	3542.496	1805.285	2500	
2200	3091.787	1588.517	3094.292	1588.522	3096.798	1588.530	3099.305	1588.539	3101.814	1588.549	3104.324	1588.562	3106.835	1588.575	3109.348	1588.591	3111.862	1588.608	3114.377	1588.627	3116.893	1588.647	3119.411	1588.669	3121.930	1588.693	2200	
2000	2811.399	1444.107	2813.904	1444.114	2816.410	1444.122	2818.918	1444.132	2821.428	1444.144	2823.939	1444.157	2826.451	1444.172	2828.965	1444.189	2831.480	1444.208	2833.997	1444.229	2836.515	1444.251	2839.035	1444.275	2841.556	1444.301	2000	
1800	2531.010	1299.698	2533.516	1299.706	2536.023	1299.714	2538.532	1299.725	2541.043	1299.738	2543.555	1299.753	2546.069	1299.770	2548.584	1299.788	2551.101	1299.810	2553.619	1299.833	2556.140	1299.858	2558.662	1299.885	2561.185	1299.914	1800	
1500	2110.428	1083.085	2112.935	1083.094	2115.443	1083.104	2117.954	1083.117	2120.467	1083.133	2122.981	1083.151	2125.498	1083.171	2128.016	1083.194	2130.537	1083.219	2133.059	1083.247	2135.583	1083.277	2138.109	1083.309	2140.637	1083.344	1500	
1200	1689.846	866.473	1692.355	866.484	1694.866	866.497	1697.379	866.513	1699.895	866.533	1702.413	866.555	1704.934	866.581	1707.457	866.609	1709.982	866.640	1712.510	866.675	1715.040	866.712	1717.573	866.753	1720.108	866.796	1200	
1000	1409.459	722.066	1411.969	722.078	1414.483	722.095	1416.999	722.113	1419.517	722.138	1422.039	722.165	1424.564	722.195	1427.092	722.229	1429.622	722.267	1432.155	722.308	1434.692	722.353	1437.231	722.401	1439.773	722.453	1000	
900	1269.266	649.863	1271.778	649.877	1274.292	649.893	1276.810	649.917	1279.331	649.942	1281.855	649.972	1284.382	650.006	1286.913	650.044	1289.447	650.086	1291.984	650.132	1294.524	650.181	1297.068	650.235	1299.615	650.293	900	
800	1129.073	577.660	1131.586	577.676	1134.102	577.696	1136.622	577.720	1139.146	577.750	1141.673	577.783	1144.204	577.821	1146.739	577.864	1149.277	577.911	1151.818	577.963	1154.364	578.019	1156.912	578.079	1159.465	578.144	800	
700	988.881	505.458	991.396	505.476	993.914	505.499	996.437	505.527	998.964	505.561	1001.495	505.599	1004.031	505.643	1006.570	505.691	1009.113	505.745	1011.661	505.804	1014.212	505.868	1016.768	505.937	1019.328	506.011	700	100 (P)*
600	848.689	433.257	851.207	433.278	853.728	433.305	856.255	433.337	858.786	433.376	861.323	433.421	863.864	433.472	866.409	433.529	868.960	433.591	871.516	433.660	874.076	433.735	876.641	433.816	879.210	433.903	600	
500	708.499	361.057	711.020	361.083	713.546	361.115	716.078	361.154	718.615	361.201	721.159	361.254	723.708	361.315	726.263	361.384	728.823	361.459	731.390	361.542	733.962	361.631	736.540	361.728	739.123	361.832	500	
450	568.311	288.860	570.837	288.892	573.369	288.932	575.909	288.981	578.456	289.040	581.010	289.107	583.572	289.183	586.140	289.269	588.716	289.362	591.299	289.466	593.888	289.577	596.485	289.698	599.089	289.828	450	
400	512.237	259.983	514.765	260.018	517.302	260.062	519.846	260.117	522.398	260.182	524.958	260.257	527.526	260.342	530.102	260.436	532.686	260.541	535.278	260.655	537.877	260.780	540.484	260.914	543.099	261.059	400	
350	456.219	252.764	300.748	252.799	503.285	252.846	505.830	252.902	508.384	252.969	510.946	253.045	513.516	253.132	516.094	253.230	518.680	253.337	521.274	253.455	523.877	253.583	526.487	253.721	529.105	253.870	350	
300	428.127	216.669	430.661	216.711	433.205	216.765	435.758	216.830	438.320	216.908	440.892	216.998	443.474	217.099	446.065	217.213	448.665	217.338	451.274	217.476	433.894	217.625	456.521	217.786	459.159	217.959	300	80 (P)*
250	358.039	180.577	360.580	180.627	363.132	180.692	365.695	180.771	368.270	180.864	370.856	180.971	373.453	181.094	376.062	181.230	378.682	181.380	381.313	181.545	383.955	181.724	386.608	181.918	389.272	182.125	250	
230	330.004	166.142	332.548	166.196	335.105	166.266	337.674	166.352	340.255	166.454	342.849	166.571	345.455	166.703	348.073	166.851	350.702	167.013	353.344	167.194	355.998	167.388	358.664	167.599	361.342	167.824	230	
200	287.955	144.491	290.505	144.553	293.070	144.634	295.649	144.733	298.242	144.849	300.850	144.984	303.471	145.136	306.106	145.306	308.755	145.494	311.417	145.700	314.094	145.924	316.783	146.166	319.486	146.426	200	
175	245.908	122.844	248.467	122.917	251.043	123.012	253.636	123.128	256.245	123.265	258.871	123.423	261.513	123.603	264.171	123.803	266.845	124.024	269.535	124.266	272.241	124.529	274.963	124.813	277.699	125.118	175	65 (P)*
155	224.886	112.022	227.451	112.103	230.034	112.207	232.636	112.334	235.256	112.485	237.893	112.658	240.548	112.854	243.221	113.074	245.912	113.316	248.619	113.582	251.344	113.870	254.086	114.182	256.844	114.516	155	
125	182.845	90.185	185.428	90.486	188.031	90.815	190.656	90.773	193.304	90.959	195.973	91.174	198.664	91.417	201.377	91.689	204.110	91.990	206.865	92.318	209.640	92.676	212.435	93.061	215.251	93.475	125	
100	147.625	72.366	150.425	72.492	153.053	72.653	155.709	72.850	158.392	73.083	161.101	73.351	163.837	73.655	166.600	73.995	169.388	74.370	172.201	74.780	175.039	75.225	177.902	75.705	180.789	76.221	100	
90	133.819	65.164	136.431	65.303	139.072	65.482	141.745	65.701	144.447	65.960	147.179	66.258	149.940	66.595	152.729	66.972	155.547	67.388	158.392	67.843	161.264	68.337	164.163	68.870	167.088	69.441	90	50 (P)*
80	119.818	57.966	122.442	58.123	125.101	58.324	127.794	58.570	130.521	58.861	133.280	59.196	136.071	59.575	138.894	59.998	141.747	60.466	144.631	60.977	147.545	61.531	150.487	62.129	153.458	62.770	80	50 (H)**
70	104.821	50.774	108.463	50.943	111.144	51.183	113.863	51.464	116.620	51.786	119.413	52.179	122.243	52.617	125.107	53.094	128.006	53.627	130.938	54.209	133.903	54.843	136.899	55.532	139.927	56.251	70	
60	91.832	43.592	94.497	43.801	97.206	44.069	99.960	44.397	102.756	44.783	105.594	45.229	108.473	45.732	111.392	46.294	114.348	46.913	117.342	47.590	120.372	48.323	123.436	49.112	126.534	49.957	60	40 (P)*
55	84.841	40.006	87.520	40.224	90.248	40.527	93.023	40.884	95.844	41.305	98.711	41.790	101.620	42.339	104.572	42.950	107.564	43.624	110.595	44.360	113.664	45.156	116.769	46.014	119.909	46.930	55	
50	77.854	36.425	80.351	36.676	83.300	36.997	86.100	37.390	88.951	37.853	91.850	38.385	94.795	38.988	97.785	39.658	100.818	40.397	103.893	41.203	107.007	42.075	110.159	43.012	113.346	44.014	50	40 (H)**
45	70.872	33.251	73.589	33.529	76.365	33.486	79.196	33.922	82.081	34.435	85.019	35.025	88.007	35.692	91.042	36.435	94.124	37.252	97.248	38.142	100.414	39.105	103.619	40.139	106.859	41.242	45	35 (P)*
40	63.897	29.285	66.640	29.598	69.447	29.999	72.316	30.488	75.244	31.064	78.228	31.727	81.267	32.474	84.356	33.304	87.494	34.218	90.677	35.211	93.902	36.285	97.167	37.435	100.467	38.661	40	35 (H) 30 (P)*
35	56.932	25.732	59.707	26.089	62.554	26.547	65.469	27.105	68.450	27.761	71.492	28.514	74.592	29.362	77.746	30.305	80.951	31.338	84.201	32.461	87.494	33.671	90.825	34.966	94.190	36.342	35	
33	45.149	24.316	56.939	24.695	59.805	25.180	62.743	25.770	65.748	26.465	68.817	27.261	71.946	28.158	75.129	29.153	78.364	30.244	81.643	31.428	84.966	32.702	88.329	34.064	91.717	35.509	33	
30	40.980	22.198	52.797	22.614	55.696	23.147	58.671	23.795	61.718	24.556	64.832	25.426	68.008	26.409	71.240	27.495	74.522	28.683	77.850	29.971	81.218	31.353	84.619	32.827	88.049	34.389	30	30 (H)**
25	43.050	18.695	45.925	19.193	48.893	19.829	51.947	20.601	55.079	21.506	58.284	22.540	61.552	23.698	64.875	24.976	68.246	26.368	71.657	27.868	75.098	29.471	78.565	31.176	82.057	32.958	25	
23	40.288	17.306	43.191	17.847	46.193	18.536	49.286	19.373	52.460	20.351	55.707	21.466	59.017	22.713	62.380	24.083	65.787	25.577	69.229	27.180	72.695	28.887	76.175	30.689			23	25 (P)*
20	36.158	15.244	39.114	15.863	42.128	16.652	45.339	17.606	48.583	18.718	51.909	19.980	55.232	21.386	58.699	22.926	62.136	24.589	65.633	26.367							20	25 (H)**
15	29.336	11.897	32.416	12.714	35.620	13.747	38.925	14.985	42.310	16.414	45.751	18.016	49.225	19.773													15	20 (P)*
14	27.985	11.250	31.098	12.122	34.337	13.222	37.676	14.427	41.092	16.048	44.551	17.736															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 109 Degrees

$\Delta = 109°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3545.014	1805.309	3547.533	1805.332	3550.054	1805 355	3552.575	1805.383	3555.098	1805.410	3557.622	1805.441	3560.147	1805.473	3562.673	1805.504	3565.200	1805.539	3567.729	1805.574	3570.259	1805.609	3572.789	1805.648	3575.322	1805.688	2500	
2200	3124.451	1588.718	3126.972	1588.745	3129.496	1588.773	3132.020	1588.804	3134.546	1588.836	3137.073	1588.869	3139.602	1588.904	3142.131	1588.941	3144.662	1588.979	3147.195	1589.019	3149.728	1589.061	3152.263	1589.104	3154.799	1589.148	2200	
2000	2844.079	1444.329	2846.603	1444.359	2849.128	1444.390	2851.655	1444.423	2854.183	1444.458	2856.713	1444.495	2859.244	1444.534	2861.777	1444.574	2864.311	1444.616	2866.846	1444.660	2869.384	1444.706	2871.922	1444.753	2874.461	1444.802	2000	
1800	2563.710	1299.945	2566.237	1299.978	2568.765	1300.012	2571.295	1300.049	2573.826	1300.088	2576.359	1300.129	2578.894	1300.172	2581.430	1300.217	2583.968	1300.263	2586.507	1300.312	2589.048	1300.363	2591.591	1300.416	2594.135	1300.471	1800	
1500	2143.167	1083.381	2145.699	1083.420	2148.233	1083.462	2150.769	1083.506	2153.307	1083.553	2155.846	1083.602	2158.388	1083.654	2160.931	1083.707	2163.477	1083.763	2166.024	1083.822	2168.573	1083.883	2171.124	1083.946	2173.677	1084.012	1500	
1200	1722.645	866.842	1725.186	866.892	1727.727	866.944	1730.272	866.999	1732.819	867.058	1735.369	867.119	1737.920	867.183	1740.475	867.250	1743.031	867.321	1745.590	867.394	1748.151	867.470	1750.715	867.549	1753.281	867.631	1200	
1000	1442.318	722.509	1444.866	722.568	1447.416	722.631	1449.969	722.697	1452.526	722.767	1455.085	722.841	1457.647	722.918	1460.212	722.999	1462.780	723.083	1465.351	723.171	1467.924	723.262	1470.500	723.357	1473.079	723.456	1000	
900	1302.164	650.355	1304.717	650.421	1307.273	650.490	1309.833	650.564	1312.395	650.642	1314.961	650.723	1317.530	650.809	1320.102	650.899	1322.677	650.992	1325.255	651.090	1327 837	651.192	1330.421	651.297	1333.009	651.407	900	
800	1162.021	578.214	1164.580	578.288	1167.144	578.366	1169.710	578.449	1172.280	578.537	1174.854	578.629	1177.432	578.725	1180.012	578.826	1182.597	578.931	1185.185	579.041	1187.776	579.155	1190.371	579.274	1192.970	579.397	800	
700	1021.892	506.091	1024.460	506.175	1027.032	506.265	1029.608	506 360	1032.188	506.460	1034.772	506.564	1037.360	506.675	1039.953	506.790	1042.549	506.910	1045.149	507.036	1047.753	507.167	1050.362	507.302	1052.974	507.443	700	
600	881.785	433.995	884.364	434.094	886.948	434.198	889.536	434.309	892.130	434.426	894.727	434.548	897.330	434.677	899.937	434.811	902.549	434.951	905.166	435.098	907.787	435.250	910.413	435.408	913.043	435.573	600	
500	741.712	361.943	744.306	362.061	746.907	362.187	749.513	362.320	752.124	362.459	754.741	362.606	757.364	362.760	759.992	362.922	762.626	363.090	765.265	363.266	767.910	363.448	770.560	363.639	773.216	363.835	500	
400	601 699	289.968	604.317	290.115	606.942	290.272	609.574	290.438	612.212	290.613	614.857	290.796	617.510	290.989	620 169	291.191	622.835	291.401	625.508	291.620	628.187	291.849	630.873	292.086	633.566	292.332	400	
360	545.722	261 213	548,352	261.377	550.991	261.552	553.636	261.736	556.290	261.929	558 951	262.134	561.620	262.348	564.296	262.572	566.979	262.805	569.670	263.049	572.369	263.302	575.075	263.566	577.788	263.839	360	100 (P)*
350	531.731	254.029	534.365	254 198	537 007	254.377	539.657	254.566	542.313	254.766	544.980	254.976	547.654	255.196	550.335	255.426	553.023	255.666	555.719	255.917	558.424	256.178	561.135	256.449	563.854	256.730	350	
300	461.806	218.145	464.461	218.342	467.126	218 551	469.800	218.772	472.483	219.004	475.175	219.249	477.875	219.505	480.585	219.774	483.304	220.054	486.031	220.346	488.767	220.650	491.512	220.966	494.266	221.294	300	
250	391.946	182.348	394.632	182.584	397 328	182.834	400.035	183.099	402.753	183 378	405.481	183.672	408.220	183.979	410.969	184.301	413.729	184.637	416.500	184.987	419.280	185.351	422.070	185.729	424.871	186.122	250	
230	364.031	168.066	366.732	168.323	369.445	168.595	372.169	168.883	374.905	169.186	377.651	169.504	380.410	169.839	383.179	170.188	385.960	170.553	388.752	170.933	391.555	171.329	394.369	171.740	397.194	172.166	230	80 (P)*
200	322.203	146.703	324.932	146 998	327.675	147.311	330.431	147.641	333.199	147.990	335.981	148.355	338.775	148.739	341.583	149.141	344.402	149.560	347.234	149.996	350.078	150.450	352.935	150.922	355.804	151.411	200	
170	280.452	125.444	283.219	125.791	286.002	126.159	288.800	126.547	291.613	126.956	294.440	127.386	297.282	127.836	300.138	128.308	303.009	128.799	305.894	129.312	308.792	129.844	311.705	130.397	314.631	130.971	170	
155	259.619	114.873	262.411	115.253	265.219	115.656	268.043	116.082	270.883	116.530	273.740	117.000	276.611	117.494	279.499	118.010	282.401	118.548	285.319	119.109	288.252	119.692	291.199	120.297	294.161	120.925	155	65 (P)*
125	218.087	93.917	220.942	94.386	223.817	94.884	226.711	95.410	229.624	95.964	232.556	96.545	235.506	97.154	238.474	97.790	241.460	98.454	244.463	99.146	247.484	99.864	250.521	109.609	253.575	101.382	125	
100	183.699	76.771	186.633	77.356	189.590	77.975	192.569	78.629	195.570	79.316	198.593	80.038	201.637	80.794	204.701	81.583	207.786	82.405	210.891	83.261	214.014	84.150	217.157	85.071	220.318	86.025	100	
90	170.030	70.051	173.013	70.699	176.013	71.385	179.037	72.108	182.085	72.870	185.155	73.668	188.247	74.503	191.361	75.376	194.497	76.284	197.652	77.229	200.828	78.210	204.023	79.226	207.237	80.277	90	50 (P)
80	156.456	63.453	159.482	64.179	162.533	64.947	165.610	65.757	168.712	66.609	171.839	67.502	174.988	68.435	178.160	69.409	181.354	70.423	184.569	71.477	187.804	72.569	191.059	73.701	194.333'	74.870	80	50 (H)**
70	142.984	57.028	146.070	57.853	149.184	58.725	152.325	59.644	155.492	60.609	158.685	61.620	161.901	62.676	165.141	63.777	168.403	64.923	171.686	66.111	174.989	67.343	178.311	68.616	181.651	69.932	70	
60	129.664	50.856	132.825	51.810	136.015	52.817	139.234	53.877	142.479	54.989	145.750	56.153	149.045	57.366	152.362	58.630	155.701	59.941	159.059	61.301	162.436	62.707	165.830	64.159	169.239	65.655	60	40 (P)*
55	123.082	47.906	126.287	48.940	129.521	50.031	132.784	51.178	136.074	52.380	139.388	53.637	142.726	54.946	146.085	56.308	149.464	57.720	152.861	59.182	156.275	60.692	159.704	62.250	163.146	63.853	55	
50	116.567	45.080	119.820	46.207	123.103	47.396	126.414	48.644	129.751	49.951	133.111	51.315	136.493	52.735	139.895	54.209	143.314	55.736	146.749	57.314	150.197	58.942	153.657	60.618	157.125	62.340	50	40 (H)**
45	110.134	42.414	113.440	43.652	116.775	44.956	120.137	46.323	123.522	47.752	126.929	49.241	130.355	50.788	133.797	52.391	137.252	54.049	140.718	55.758	144.194	57.518	147.675	59.325	151.159	61.178	45	35 (P)*
40	103.800	39.961	107.164	41.332	110.553	42.772	113.966	44.280	117.399	45.851	120.849	47.485	124.312	49.179	127.786	50.929	131.266	52.733	134.751	54.589							40	30 (H)**
35	97.585	37.797	101.006	39.327	104.447	40.930	107.906	42.603	111.378	44.341	114.858	46.142															35	
33	95.136	37.035	98.577	38.638	102.037	40.315	105.510	42.061	108.991	43.872																	33	30 (P)*
30	91.501	36.033	94.970	37.755	98.450	39.550																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 110 Degrees

Δ=110°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	3577.871	1858.621	3580.375	1858.625	3582.881	1858.633	3585.387	1858.641	3587.895	1858.648	3590.404	1858.660	3592.914	1858.672	3595.426	1858.687	3597.938	1858.703	3600.451	1858.719	3602.966	1858.734	3605.482	1858.758	3608.000	1858.777	2500	
2200	3149.428	1635.587	3151.933	1635.593	3154.439	1635.600	3156.946	1635.610	3159.455	1635.620	3161.965	1635.633	3164.477	1635.647	3166.990	1635.662	3169.504	1635.680	3172.019	1635.699	3174.536	1635.719	3177.054	1635.742	3179.574	1635.765	2200	
2000	2863.799	1486.899	2866.305	1486.905	2868.811	1486.913	2871.320	1486.924	2873.829	1486.936	2876.341	1486.949	2878.853	1486.964	2881.367	1486.981	2883.882	1487.000	2886.399	1487.021	2888.918	1487.044	2891.438	1487.069	2893.960	1487.095	2000	
1800	2578.171	1338.211	2580.677	1338.218	2583.184	1338.227	2585.693	1338.238	2588.204	1338.251	2590.717	1338.266	2593.230	1338.283	2595.746	1338.302	2598.263	1338.324	2600.782	1338.347	2603.303	1338.372	2605.825	1338.400	2608.349	1338.428	1800	
1500	2149.729	1115.179	2152.236	1115.188	2154.744	1115.198	2157.255	1115.211	2159.768	1115.227	2162.283	1115.246	2164.800	1115.266	2167.318	1115.289	2169.839	1115.314	2172.362	1115.343	2174.887	1115.373	2177.413	1115.406	2179.942	1115.440	1500	
1200	1721.287	892.148	1723.795	892.159	1726.307	892.172	1728.820	892.189	1731.336	892.208	1733.855	892.231	1736.376	892.257	1738.899	892.286	1741.425	892.317	1743.953	892.352	1746.484	892.390	1749.018	892.431	1751.553	892.475	1200	
1000	1435.660	743.462	1438.170	743.474	1440.684	743.491	1443.200	743.511	1445.719	743.534	1448.241	743.562	1450.767	743.593	1453.295	743.627	1455.825	743.665	1458.359	743.707	1460.896	743.752	1463.436	743.801	1465.979	743.854	1000	
900	1292.847	669.119	1295.358	669.133	1297.873	669.152	1300.391	669.174	1302.912	669.200	1305.437	669.230	1307.965	669.264	1310.496	669.303	1313.031	669.345	1315.569	669.392	1318.110	669.442	1320.654	669.496	1323.202	669.555	900	
800	1150.034	594.777	1152.547	594.792	1155.063	594.813	1157.584	594.838	1160.108	594.867	1162.635	594.901	1165.167	594.940	1167.702	594.983	1170.241	595.031	1172.783	595.083	1175.330	595.140	1177.879	595.201	1180.433	595.267	800	
700	1007.222	520.435	1009.737	520.453	1012.255	520.477	1014.779	520.505	1017.306	520.539	1019.838	520.578	1022.374	520.622	1024.914	520.671	1027.458	520.726	1030.007	520.785	1032.559	520.850	1035.116	520.920	1037.677	520.995	700	100 (P)*
650	864.410	446.094	866.927	446.116	869.450	446.143	871.977	446.176	874.509	446.215	877.046	446.261	879.588	446.313	882.134	446.370	884.686	446.433	887.242	446.503	889.804	446.579	892.370	446.661	894.941	446.748	650	
600	721.690	371.755	724.121	371.781	726.647	371.813	729.180	371.853	731.718	371.901	734.263	371.955	736.813	372.017	739.368	372.086	741.930	372.162	744.498	372.246	747.071	372.336	749.651	372.434	752.236	372.540	600	
550	578.792	297.419	581.318	297.451	583.851	297.492	586.392	297.542	588.940	297.601	591.495	297.669	594.057	297.746	596.627	297.832	599.204	297.927	601.789	298.032	604.380	298.145	606.978	298.268	609.584	298.399	550	
500	521.670	267.686	524.199	267.721	526.735	267.766	529.281	267.822	531.834	267.888	534.395	267.963	536.965	268.049	539.542	268.145	542.127	268.251	544.721	268.366	547.322	268.492	549.931	268.629	552.549	268.775	500	
450	507.390	260.253	509.919	260.289	512.457	260.336	515.003	260.393	517.558	260.460	520.121	260.538	522.692	260.626	525.272	260.725	527.860	260.834	530.456	260.953	533.060	261.083	535.672	261.222	538.293	261.373	450	
400	435.968	223.068	438.523	223.131	441.067	223.185	443.621	223.251	446.185	223.330	448.758	223.421	451.341	223.524	453.934	223.639	456.536	223.766	459.148	223.905	461.769	224.056	464.399	224.219	467.039	224.395	400	80 (P)*
350	364.590	185.927	367.131	185.978	369.684	186.043	372.249	186.123	374.825	186.217	377.413	186.326	380.012	186.450	382.623	186.588	385.245	186.740	387.879	186.907	390.523	187.088	393.179	187.284	395.846	187.495	350	
330	336.632	171.063	338.376	171.119	341.134	171.190	343.704	171.277	346.287	171.379	348.882	171.498	351.490	171.632	354.110	171.782	356.743	171.947	359.387	172.129	362.044	172.326	364.713	172.539	367.394	172.767	330	
300	293.196	148.771	295.748	148.834	298.313	148.916	300.894	149.016	303.489	149.134	306.099	149.270	308.722	149.424	311.360	149.597	314.011	149.787	316.677	149.996	319.357	150.222	322.050	150.467	324.757	150.730	300	
270	250.363	126.482	252.924	126.557	255.501	126.653	258.096	126.770	260.707	126.909	263.335	127.069	265.980	127.250	268.641	127.453	271.319	127.677	274.012	127.922	276.722	128.189	279.448	128.476	282.190	128.785	270	65 (P)*
250	228.948	115.340	231.515	115.421	234.100	115.527	236.703	115.656	239.325	115.808	241.965	115.983	244.624	116.182	247.300	116.405	249.994	116.650	252.706	116.919	255.435	117.211	258.181	117.526	260.945	117.865	250	
225	206.124	93.661	208.707	93.163	191.312	93.294	191.939	93.453	196.590	93.642	199.262	93.860	201.957	94.106	204.673	94.381	207.412	94.686	210.171	95.019	212.952	95.380	215.753	95.770	218.575	96.189	225	
200	150.447	74.508	153.049	74.635	155.680	74.798	138.339	74.998	161.025	75.233	163.739	75.505	166.480	75.813	169.247	76.157	172.041	76.536	174.860	76.951	177.705	77.402	180.575	77.889	183.470	78.410	200	
180	136.160	67.092	138.793	67.233	141.438	67.414	144.114	67.636	146.820	67.898	149.556	68.199	152.322	68.541	155.117	68.922	157.941	69.344	160.793	69.804	163.673	70.304	166.580	70.844	169.513	71.422	180	50 (P)*
160	121.917	59.680	124.544	59.839	127.206	60.043	129.903	60.292	132.633	60.586	135.398	60.925	138.195	61.309	141.024	61.738	143.884	62.211	146.776	62.728	149.698	63.290	152.650	63.895	155.630	64.543	160	50 (H)**
140	107.659	52.275	110.303	52.456	112.938	52.689	115.711	52.974	118.473	53.310	121.272	53.697	124.108	54.135	126.980	54.624	129.887	55.165	132.828	55.755	135.805	56.397	138.809	57.091	141.847	57.839	140	
120	93.408	44.879	96.076	45.091	98.790	45.362	101.548	45.694	104.351	46.085	107.195	46.536	110.082	47.046	113.009	47.615	115.975	48.242	118.979	48.927	122.020	49.669	125.097	50.468	128.207	51.323	120	40 (P)*
110	86.287	41.186	88.969	41.417	91.702	41.713	94.482	42.075	97.310	42.502	100.183	42.993	103.101	43.548	106.062	44.167	109.064	44.849	112.107	45.594	115.188	46.401	118.306	47.269	121.460	48.197	110	
100	79.169	37.499	81.869	37.751	84.623	38.078	87.430	38.476	90.288	38.944	93.194	39.484	96.149	40.093	99.149	40.772	102.194	41.520	105.281	42.336	108.408	43.219	111.574	44.168	114.777	45.182	100	40 (H)**
90	72.057	33.818	74.728	34.100	77.539	34.461	80.397	34.902	83.290	35.422	86.237	36.020	89.234	36.695	92.281	37.447	95.375	38.274	98.513	39.175	101.694	40.150	104.914	41.198	108.172	42.314	90	35 (P)*
80	64.951	30.146	67.699	30.463	70.512	30.869	73.388	31.364	76.325	31.947	79.319	32.618	82.369	33.374	85.472	34.215	88.623	35.140	91.821	36.146	95.063	37.232	98.345	38.397	101.664	39.639	80	35 (H) 30 (P)*
70	57.856	26.487	60.636	26.848	63.490	27.312	66.414	27.876	69.405	28.541	72.458	29.303	75.571	30.162	78.740	31.116	81.960	32.162	85.228	33.299	88.539	34.525	91.890	35.835	95.276	37.228	70	
65	53.021	25.028	57.817	25.411	60.691	25.902	63.637	26.500	66.653	27.203	69.734	28.010	72.876	28.918	76.075	29.925	79.326	31.030	82.624	32.229	85.966	33.519	89.346	34.897	92.759	36.360	65	
60	50.774	22.847	53.598	23.268	56.504	23.807	59.490	24.463	62.548	25.234	65.675	26.117	68.866	27.109	72.114	28.209	75.415	29.412	78.763	30.716	82.151	32.116	85.575	33.608	89.029	34.189	60	30 (H)**
55	43.715	19.238	46.597	19.742	49.575	20.386	52.640	21.168	55.787	22.084	59.007	23.130	62.293	24.303	65.636	25.596	69.028	27.006	72.467	28.525	75.947	30.149	79.467	31.866	82.023	33.678	55	
50	40.901	17.807	43.813	18.354	46.825	19.053	49.931	19.899	53.120	20.889	56.383	22.018	59.712	23.281	63.096	24.670	66.526	26.180	69.992	27.803	73.484	29.531	76.992	31.357			50	25 (P)*
45	38.694	15.082	39.660	16.309	42.736	17.108	45.911	18.073	49.172	19.199	52.509	20.477	55.906	21.900	59.353	23.459	62.834	25.143	66.339	26.943							45	
40	29.745	12.232	32.838	13.058	36.057	14.105	39.381	15.358	42.788	16.804	46.253	18.426	49.754	20.207													40	20 (P)*
35	28.369	11.564	31.496	12.446	34.751	13.560	38.110	14.891	41.547	16.421	45.034	18.131															35	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 110 Degrees

$\Delta = 110°$

R_c	$L_s = 80$ metres		$L_s = 85$ metres		$L_s = 90$ metres		$L_s = 95$ metres		$L_s = 100$ metres		$L_s = 105$ metres		$L_s = 110$ metres		$L_s = 115$ metres		$L_s = 120$ metres		$L_s = 125$ metres		$L_s = 130$ metres		$L_s = 135$ metres		$L_s = 140$ metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s				
metre																									metre			
2500	3610.518	1858.801	3613.037	1858.824	3615.558	1858.848	3618.080	1858.875	3620.603	1858.902	3623.128	1858.934	3625.653	1858.965	3628.180	1858.996	3630.708	1859.031	3633.237	1859.066	3635.767	1859.105	3638.298	1859.145	3640.831	1859.184	2500	
2200	3182.094	1635.791	3184.617	1635.818	3187.140	1635.847	3189.665	1635.878	3192.192	1635.910	3194.719	1635.944	3197.248	1635.979	3199.779	1636.017	3202.310	1636.055	3204.843	1636.096	3207.377	1636.138	3209.913	1636.182	3212.449	1636.227	2200	
2000	2896.483	1487.123	2899.007	1487.153	2901.533	1487.185	2904.060	1487.219	2906.589	1487.254	2909.120	1487.291	2911.651	1487.331	2914.185	1487.371	2916.719	1487.414	2919.256	1487.458	2921.793	1487.505	2924.333	1487.553	2926.873	1487.603	2000	
1800	2610.874	1338.460	2613.402	1338.493	2615.930	1338.529	2618.461	1338.566	2620.993	1338.605	2623.526	1338.646	2626.062	1338.690	2628.599	1338.735	2631.137	1338.783	2633.677	1338.832	2636.219	1338.884	2638.763	1338.937	2641.308	1338.993	1800	
1500	2182.472	1115.478	2185.005	1115.518	2187.540	1115.561	2190.076	1115.605	2192.614	1115.653	2195.155	1115.702	2197.697	1115.754	2200.241	1115.809	2202.788	1115.865	2205.336	1115.925	2207.886	1115.987	2210.438	1116.051	2212.992	1116.117	1500	
1200	1754.092	892.522	1756.632	892.572	1759.175	892.625	1761.720	892.681	1764.269	892.740	1766.819	892.802	1769.372	892.867	1771.927	892.935	1774.485	893.006	1777.045	893.080	1779.607	893.157	1782.172	893.238	1784.740	893.321	1200	
1000	1468.525	743.910	1471.074	743.970	1473.625	744.034	1476.180	744.101	1478.737	744.172	1481.297	744.246	1483.861	744.324	1486.427	744.406	1488.996	744.491	1491.568	744.580	1494.143	744.673	1496.720	744.769	1499.301	744.869	1000	
900	1323.732	669.618	1328.306	669.684	1330.864	669.755	1333.424	669.829	1335.988	669.908	1338.555	669.990	1341.125	670.077	1343.698	670.168	1346.275	670.263	1348.854	670.362	1351.438	670.465	1354.024	670.572	1356.613	670.683	900	
800	1182.990	595.337	1185.551	595.412	1188.115	595.492	1190.683	595.576	1193.254	595.664	1195.830	595.757	1198.408	595.855	1200.991	595.957	1203.577	596.063	1206.167	596.175	1208.759	596.290	1211.356	596.411	1213.957	596.535	800	
700	1040.242	521.076	1042.811	521.161	1045.383	521.252	1047.962	521.348	1050.544	521.449	1053.130	521.555	1055.719	521.667	1058.314	521.784	1060.912	521.906	1063.514	522.033	1066.120	522.165	1068.730	522.302	1071.345	522.445	700	
600	897.517	446.942	900.097	446.942	902.683	447.048	905.273	447.160	907.868	447.278	910.468	447.402	913.072	447.532	915.682	447.668	918.296	447.810	920.914	447.958	923.538	448.113	926.166	448.273	928.799	448.439	600	
500	754.826	372.652	757.422	372.772	760.025	372.899	762.633	373.034	765.246	373.175	767.865	373.324	770.490	373.480	773.121	373.643	775.757	373.814	778.399	373.991	781.047	374.177	783.700	374.369	786.358	374.568	500	
400	612.197	298.540	614.817	298.689	617.444	298.848	620.078	299.016	622.719	299.193	625.368	299.379	628.023	299.574	630.685	299.778	633.354	299.991	636.030	300.213	638.713	300.445	641.403	300.685	644.100	300.934	400	
360	555.174	268.931	557.806	269.097	560.448	269.274	563.096	269.460	565.752	269.657	568.417	269.864	571.089	270.080	573.768	270.307	576.455	270.543	579.150	270.790	581.853	271.047	584.562	271.313	587.280	271.590	360	100 (P)*
350	540.921	261.533	543.558	261.705	546.203	261.886	548.856	262.078	551.516	262.280	554.185	262.492	556.862	262.715	559.546	262.948	562.238	263.191	564.938	263.445	567.646	263.709	570.362	263.983	573.086	264.268	350	
300	469.689	224.582	472.348	224.782	475.015	224.993	477.693	225.217	480.379	225.453	483.075	225.700	485.780	225.960	488.493	226.232	491.216	226.515	493.948	226.811	496.689	227.119	499.438	227.439	502.197	227.771	300	
250	398.524	187.719	401.214	187.958	403.914	188.212	406.625	188.480	409.347	188.763	412.080	189.060	414.823	189.371	417.577	189.697	420.342	190.037	423.117	190.391	425.903	190.760	428.700	191.143	431.506	191.541	250	
230	370.087	173.012	372.792	173.272	375.509	173.547	378.238	173.839	380.978	174.146	383.730	174.468	386.493	174.806	389.268	175.160	392.054	175.530	394.852	175.915	397.661	176.315	400.481	176.731	403.312	177.163	230	
200	327.478	151.010	330.211	151.309	332.959	151.626	335.720	151.960	338.494	152.313	341.281	152.684	344.081	153.072	346.895	153.479	349.720	153.903	352.559	154.345	355.410	154.804	358.274	155.282	361.151	155.777	200	
170	284.947	129.115	287.720	129.466	290.508	129.838	293.312	130.231	296.131	130.646	298.964	131.081	301.813	131.537	304.677	132.014	307.555	132.512	310.447	133.030	313.354	133.570	316.275	134.130	319.210	134.710	170	
155	263.725	118.226	266.323	118.611	269.337	119.019	272.167	119.450	275.015	119.903	277.878	120.380	280.757	120.879	283.652	121.402	286.563	121.947	289.489	122.515	292.431	123.105	295.388	123.718	298.360	124.353	155	65 (P)*
125	221.418	96.636	224.280	97.112	227.163	97.616	230.065	98.149	232.986	98.709	235.927	99.298	238.886	99.914	241.863	100.559	244.859	101.231	247.873	101.930	250.905	102.658	253.954	103.412	257.020	104.194	125	
100	186.389	78.967	189.332	79.559	192.298	80.186	195.287	80.848	198.299	81.544	201.332	82.275	204.388	83.040	207.464	83.839	210.561	84.672	213.679	85.538	216.816	86.438	219.973	87.370	223.148	88.336	100	
90	172.473	72.040	175.458	72.696	178.469	73.390	181.504	74.123	184.563	74.893	187.645	75.702	190.750	76.547	193.877	77.430	197.026	78.350	200.197	79.307	203.387	80.300	206.598	81.328	209.828	82.393	90	50 (P)
80	158.639	65.236	161.675	65.971	164.739	66.748	167.828	67.568	170.943	68.430	174.083	69.334	177.246	70.279	180.433	71.265	183.643	72.292	186.874	73.359	190.126	74.465	193.398	75.610	196.690	76.794	80	50 (H)**
70	144.916	58.606	148.015	59.441	151.142	60.324	154.298	61.255	157.479	62.232	160.687	63.255	163.920	64.325	167.176	65.440	170.455	66.599	173.756	67.802	177.078	69.049	180.420	70.339	183.780	71.670	70	
60	131.351	52.234	134.526	53.199	137.732	54.219	140.967	55.292	144.229	56.418	147.517	57.596	150.830	58.825	154.167	60.104	157.526	61.432	160.905	62.808	164.303	64.231	167.719	65.701	171.151	67.216	60	40 (P)*
55	124.648	49.185	127.868	50.231	131.119	51.336	134.400	52.497	137.707	53.714	141.041	54.986	144.398	56.312	147.778	57.691	151.179	59.121	154.599	60.601	158.036	62.130	161.488	63.707	164.954	65.330	55	
50	118.014	46.261	121.284	47.403	124.585	48.606	127.915	49.870	131.271	51.193	134.652	52.574	138.056	54.012	141.480	55.504	144.923	57.050	148.381	58.648	151.854	60.296	155.340	61.992	158.835	63.736	50	40 (H)**
45	111.464	43.500	114.789	44.754	118.144	46.074	121.526	47.458	124.934	48.905	128.363	50.412	131.812	51.978	135.278	53.601	138.759	55.279	142.251	57.010	145.753	58.791	149.262	60.621	152.775	62.497	45	35 (P)*
40	105.017	40.954	108.401	42.343	111.812	43.801	115.248	45.327	118.705	46.918	122.180	48.572	125.669	50.287	129.169	52.059	132.677	53.885	136.190	55.764							40	30 (H)**
35	98.693	38.701	102.136	40.251	105.603	41.874	109.087	43.567	112.595	45.327	116.093	47.150															35	
33	96.201	37.906	99.667	39.529	103.153	41.226	106.652	42.993	110.161	44.827																	33	30 (P)*
30	92.506	36.853	96.001	38.596	99.508	40.414																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

△=111°

TABLE 10 :: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 111 Degrees

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s				
metre																									metre			
2500	3643.022	1513.793	3647.526	1913.801	3650.032	1913.809	3652.538	1913.816	3655.046	1913.824	3657.555	1913.836	3660.065	1913.848	3662.577	1913.863	3665.090	1913.879	3667.604	1913.895	3670.119	1913.914	3672.635	1913.934	3675.153	1913.953	2500	
2200	3208.321	1684.141	3211.026	1684.147	3213.531	1684.154	3216.039	1684.164	3218.548	1684.175	3221.059	1684.187	3223.570	1684.201	3226.083	1684.217	3228.598	1684.235	3231.113	1684.254	3233.631	1684.275	3236.149	1684.298	3238.669	1684.322	2200	
2000	2917.520	1531.039	2920.025	1531.045	2922.532	1531.053	2925.041	1531.064	2927.551	1531.076	2930.062	1531.090	2932.575	1531.105	2935.089	1531.123	2937.604	1531.142	2940.122	1531.163	2942.641	1531.186	2945.161	1531.211	2947.683	1531.238	2000	
1800	2626.319	1377.937	2629.025	1377.944	2631.533	1377.953	2634.042	1377.964	2636.553	1377.978	2639.066	1377.993	2641.580	1378.010	2644.096	1378.030	2646.614	1378.051	2649.133	1378.074	2651.654	1378.100	2654.177	1378.128	2656.701	1378.157	1800	
1500	2190.019	1148.284	2192.526	1148.293	2195.035	1148.304	2197.546	1148.317	2200.059	1148.333	2202.574	1148.351	2205.091	1148.372	2207.611	1148.396	2210.132	1148.421	2212.655	1148.450	2215.180	1148.480	2217.707	1148.513	2220.237	1148.549	1500	
1200	1753.519	918.632	1756.028	918.643	1758.540	918.657	1761.053	918.674	1763.570	918.693	1766.089	918.717	1768.610	918.742	1771.134	918.772	1773.660	918.804	1776.189	918.839	1778.721	918.877	1781.255	918.919	1783.791	918.963	1200	
1000	1462.520	765.532	1465.031	765.545	1467.545	765.562	1470.061	765.582	1472.581	765.605	1475.103	765.633	1477.629	765.665	1480.158	765.699	1482.689	765.738	1485.224	765.780	1487.761	765.826	1490.302	765.876	1492.846	765.929	1000	
900	1317.021	688.992	1319.533	688.997	1322.048	689.015	1324.566	689.038	1327.088	689.064	1329.613	689.094	1332.142	689.129	1334.674	689.168	1337.209	689.211	1339.747	689.258	1342.289	689.309	1344.834	689.364	1347.383	689.424	900	
800	1171.522	612.433	1174.035	612.449	1176.552	612.469	1179.073	612.495	1181.598	612.525	1184.126	612.559	1186.658	612.598	1189.194	612.642	1191.733	612.690	1194.277	612.743	1196.824	612.801	1199.374	612.863	1201.929	612.929	800	
700	1026.024	535.885	1028.540	535.903	1031.058	535.926	1033.582	535.955	1036.111	535.990	1038.643	536.029	1041.179	536.074	1043.720	536.123	1046.265	536.178	1048.815	536.239	1051.368	536.305	1053.926	536.376	1056.488	536.452	700	100 (P)*
600	880.527	459.337	883.044	459.358	885.567	459.386	888.095	459.419	890.627	459.459	893.165	459.505	895.708	459.557	898.255	459.616	900.808	459.680	903.365	459.750	905.928	459.827	908.495	459.910	911.067	459.999	600	
500	735.031	382.791	737.552	382.817	740.070	382.849	742.612	382.890	745.151	382.938	747.696	382.993	750.247	383.055	752.804	383.125	755.367	383.202	757.936	383.287	760.511	383.379	763.092	383.478	765.678	383.585	500	
400	589.537	306.248	592.063	306.280	594.597	306.321	597.138	306.372	599.687	306.432	602.244	306.500	604.807	306.579	607.378	306.666	609.957	306.762	612.543	306.868	615.136	306.983	617.736	307.107	620.344	307.240	400	
360	531.440	275.632	533.870	275.667	536.407	275.713	538.953	275.770	541.507	275.836	544.070	275.912	546.640	275.999	549.219	276.096	551.806	276.204	554.402	276.321	557.005	276.448	559.616	276.586	562.236	276.735	360	
350	516.792	267.978	519.321	268.014	521.860	268.062	524.407	268.120	526.963	268.188	529.527	268.267	532.100	268.356	534.681	268.456	537.271	268.566	539.868	268.687	542.475	268.818	545.089	268.960	547.712	269.112	350	
300	444.047	229.710	446.583	229.753	449.128	229.808	451.683	229.875	454.248	229.955	456.822	230.047	459.407	230.151	462.001	230.268	464.605	230.396	467.219	230.537	469.843	230.690	472.476	230.855	475.118	231.033	300	80 (P)*
250	371.306	191.445	373.848	191.497	376.402	191.563	378.968	191.644	381.546	191.739	384.135	191.850	386.737	191.975	389.349	192.114	391.974	192.269	394.610	192.437	397.257	192.621	399.916	192.820	402.587	193.033	250	
230	342.211	176.449	344.756	176.497	347.315	176.566	349.886	176.656	352.471	176.760	355.068	176.880	357.678	176.716	360.301	176.868	362.935	177.036	365.583	177.219	368.243	177.419	370.915	177.635	373.600	177.866	230	
200	298.569	153.198	301.122	153.250	303.689	153.333	306.271	153.434	308.868	153.553	311.479	153.691	314.105	153.848	316.746	154.022	319.400	154.215	322.069	154.426	324.752	154.656	327.449	154.903	330.160	155.169	200	
170	254.931	130.235	257.493	130.311	260.072	130.408	262.668	130.527	265.282	130.667	267.912	130.830	270.560	131.013	273.224	131.219	275.905	131.445	278.603	131.694	281.316	131.963	284.047	132.255	286.793	132.567	170	65 (P)*
155	233.113	118.762	235.681	118.845	238.268	118.951	240.873	119.082	243.497	119.236	246.140	119.414	248.802	119.615	251.481	119.840	254.179	120.089	256.895	120.361	259.628	120.657	262.380	120.976	265.148	121.319	155	
125	189.484	95.822	192.068	95.925	194.675	96.057	197.305	96.219	199.958	96.410	202.634	96.630	205.333	96.880	208.053	97.159	210.796	97.467	213.561	97.806	216.347	98.175	219.154	98.565	221.983	98.989	125	
100	153.136	76.717	155.740	76.846	158.373	77.011	161.035	77.213	163.725	77.452	166.443	77.727	169.188	78.038	171.961	78.387	174.760	78.771	177.586	79.191	180.438	79.648	183.316	80.140	186.219	80.669	100	
90	138.500	69.080	141.216	69.223	143.863	69.407	146.542	69.631	149.253	69.896	151.994	70.202	154.765	70.548	157.566	70.934	160.396	71.361	163.255	71.827	166.143	72.334	169.058	72.880	172.000	73.466	90	50 (P)*
80	124.069	61.448	126.698	61.609	129.262	61.815	132.064	62.068	134.799	62.366	137.569	62.709	140.372	63.098	143.207	63.532	146.075	64.011	148.975	64.535	151.906	65.103	154.866	65.716	157.857	66.373	80	50 (H)**
70	109.542	53.822	112.150	54.006	114.878	54.242	117.696	54.530	120.373	54.871	123.178	55.263	126.021	55.706	128.900	56.201	131.815	56.748	134.765	57.345	137.749	57.992	140.767	58.690	143.817	59.437	70	
60	95.024	46.207	97.695	46.421	100.413	46.696	103.177	47.032	105.985	47.428	108.837	47.885	111.731	48.401	114.667	48.977	117.643	49.612	120.657	50.306	123.710	51.057	126.798	51.866	129.922	52.732	60	40 (P)*
55	87.769	42.404	90.455	42.638	93.192	42.938	95.978	43.304	98.812	43.736	101.693	44.233	104.619	44.796	107.590	45.423	110.605	46.113	113.657	46.868	116.750	47.684	119.882	48.563	123.050	49.503	55	
50	80.817	38.607	83.221	38.863	85.980	39.193	88.793	39.596	91.658	40.070	94.573	40.616	97.537	41.234	100.548	41.921	103.604	42.679	106.703	43.505	109.844	44.399	113.025	45.360	116.243	46.387	50	40 (H)**
45	73.271	34.816	73.997	35.101	78.783	35.467	81.628	35.914	84.529	36.440	87.485	37.045	90.493	37.729	93.551	38.490	96.658	39.328	99.810	40.247	103.006	41.228	106.247	42.288	109.517	43.410	45	35 (P)*
40	66.031	31.034	68.784	31.355	71.604	31.766	74.487	32.267	77.433	32.858	80.438	33.537	83.500	34.303	86.615	35.155	89.781	36.091	92.994	37.110	96.253	38.210	99.553	39.390	102.891	40.647	40	35 (H) 30 (P)*
35	58.803	27.265	61.589	27.631	64.450	28.101	67.383	28.672	70.383	29.345	73.449	30.117	76.575	30.987	79.758	31.953	82.995	33.015	86.280	34.164	89.610	35.405	92.981	36.732	96.389	38.143	35	
33	55.915	25.763	58.717	26.151	61.598	26.648	64.554	27.254	67.580	27.965	70.674	28.782	73.830	29.702	77.044	30.722	80.312	31.840	83.629	33.054	86.991	34.361	90.392	35.757	93.828	37.238	33	
30	51.588	23.516	54.418	23.942	57.333	24.489	60.329	25.153	63.399	25.933	66.540	26.827	69.746	27.832	73.011	28.946	76.331	30.164	79.698	31.484	83.108	32.902	86.555	34.413	90.033	36.014	30	30 (H)**
25	44.597	19.762	47.287	20.308	50.274	20.961	53.352	21.752	56.512	22.680	59.749	23.740	63.052	24.927	66.415	26.237	69.829	27.664	73.286	29.203	76.777	30.846	80.293	32.588	83.827	34.421	25	
23	41.829	18.324	44.450	18.878	47.473	19.585	50.592	20.442	53.796	21.445	57.077	22.588	60.425	23.867	63.831	25.274	67.284	26.803	70.775	28.446	74.293	30.196	77.829	32.045			23	25 (P)*
20	37.244	16.134	40.219	16.768	43.307	17.577	46.497	18.555	49.776	19.695	53.132	20.990	56.552	22.411	60.022	24.009	63.530	25.715	67.062	27.537							20	25 (H)**
15	30.064	12.576	33.270	13.414	36.508	14.473	39.849	15.742	43.278	17.207	46.788	18.850	50.296	20.653													15	20 (P)*
14	28.763	11.887	31.903	12.781	35.176	13.909	38.555	15.257	42.015	16.806	45.329	18.537															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 111 Degrees

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=111°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3677.671	1913.977	3680.191	1914.000	3682.712	1914.027	3685.235	1914.055	3687.758	1914.082	3690.283	1914.113	3692.809	1914.145	3695.336	1914.176	3697.865	1914.211	3700.394	1914.250	3702.925	1914.285	3705.457	1914.324	3707.990	1914.363	2500	
2200	3241.190	1684.347	3243.713	1684.375	3246.237	1684.404	3248.762	1684.436	3251.290	1684.468	3253.817	1684.502	3256.347	1684.339	3258.878	1684.576	3261.410	1684.615	3263.943	1684.656	3266.478	1684.699	3269.015	1684.743	3271.552	1684.789	2200	
2000	2950.207	1531.266	2952.732	1531.297	2955.258	1531.329	2957.786	1531.363	2960.315	1531.398	2962.846	1531.436	2965.379	1531.476	2967.912	1531.517	2970.448	1531.560	2972.985	1531.605	2975.523	1531.652	2978.063	1531.701	2980.604	1531.751	2000	
1800	2659.227	1378.189	2661.754	1378.223	2664.284	1378.259	2666.815	1378.297	2669.347	1378.336	2671.882	1378.378	2674.418	1378.422	2676.955	1378.468	2679.495	1378.516	2682.036	1378.566	2684.578	1378.618	2687.123	1378.672	2689.668	1378.729	1800	
1500	2222.768	1148.587	2225.301	1148.627	2227.836	1148.670	2230.373	1148.716	2232.912	1148.763	2235.453	1148.813	2237.997	1148.866	2240.542	1148.922	2243.089	1148.979	2245.638	1149.039	2248.189	1149.102	2250.742	1149.167	2253.297	1149.234	1500	
1200	1786.330	919.011	1788.871	919.062	1791.415	919.115	1793.961	919.171	1796.510	919.231	1799.062	919.294	1801.615	919.360	1804.172	919.429	1806.730	919.501	1809.292	919.576	1811.855	919.654	1814.422	919.736	1816.990	919.820	1200	
1000	1495.392	765.986	1497.942	766.047	1500.495	766.111	1503.050	766.179	1505.609	766.251	1508.170	766.326	1510.735	766.406	1513.302	766.488	1515.872	766.574	1518.446	766.665	1521.022	766.759	1523.601	766.856	1526.183	766.957	1000	
900	1349.935	689.487	1352.490	689.554	1355.048	689.626	1357.609	689.701	1360.174	689.781	1362.742	689.865	1365.314	689.953	1367.889	690.044	1370.467	690.141	1373.048	690.240	1375.633	690.345	1378.220	690.453	1380.812	690.565	900	
800	1204.487	613.001	1207.049	613.076	1209.615	613.157	1212.184	613.242	1214.756	613.332	1217.333	613.426	1219.914	613.525	1222.497	613.628	1225.085	613.736	1227.677	613.849	1230.271	613.966	1232.870	614.088	1235.472	614.214	800	
700	1059.054	536.533	1061.625	536.620	1064.200	536.712	1066.779	536.809	1069.362	536.912	1071.949	537.019	1074.541	537.132	1077.137	537.250	1079.737	537.374	1082.341	537.502	1084.949	537.636	1087.562	537.775	1090.178	537.920	700	
600	913.645	460.094	916.227	460.195	918.814	460.302	921.406	460.416	924.003	460.535	926.604	460.660	929.211	460.792	931.822	460.930	934.438	461.074	937.060	461.224	939.686	461.380	942.316	461.543	944.952	461.711	600	
500	768.271	383.699	770.869	383.820	773.473	383.949	776.083	384.085	778.699	384.228	781.320	384.379	783.948	384.537	786.581	384.702	789.220	384.875	791.864	385.055	794.515	385.243	797.171	385.437	799.832	385.639	500	
400	622.959	307.383	625.581	307.534	628.210	307.695	630.848	307.865	633.491	308.044	636.143	308.232	638.801	308.430	641.466	308.637	644.138	308.852	646.818	309.077	649.505	309.311	652.198	309.554	654.899	309.807	400	
360	564.864	276.893	567.492	277.061	570.142	277.240	572.794	277.429	575.453	277.627	578.121	277.837	580.796	278.056	583.479	278.285	586.170	278.525	588.868	278.775	591.575	279.035	594.289	279.305	597.010	279.585	360	100 (P)*
350	550.343	269.275	552.982	269.448	555.630	269.632	558.286	269.826	560.949	270.031	563.621	270.246	566.301	270.471	568.989	270.708	571.685	270.954	574.389	271.210	577.102	271.478	579.822	271.756	582.549	272.044	350	
300	477.771	231.223	480.433	231.425	483.104	231.639	485.785	231.866	488.475	232.104	491.174	232.355	493.883	232.618	496.601	232.893	499.328	233.180	502.064	233.480	504.810	233.792	507.564	234.115	510.328	234.452	300	
250	405.268	193.260	407.961	193.503	410.665	193.760	413.380	194.031	416.106	194.317	418.844	194.618	421.592	194.933	424.351	195.263	427.122	195.607	429.902	195.966	432.694	196.340	435.496	196.728	438.309	197.130	250	
230	376.296	178.113	379.005	178.376	381.726	178.656	384.459	178.951	387.204	179.261	389.961	179.588	392.730	179.931	395.510	180.289	398.302	180.663	401.106	181.053	403.921	181.458	406.747	181.880	409.585	182.317	230	80 (P)*
200	332.885	155.454	335.624	155.756	338.376	156.077	341.142	156.416	343.922	156.773	346.715	157.148	349.521	157.542	352.340	157.953	355.173	158.383	358.018	158.830	360.877	159.296	363.748	159.779	366.632	160.281	200	
170	289.555	132.902	292.333	133.257	295.128	133.634	297.937	134.032	300.762	134.451	303.603	134.892	306.459	135.354	309.330	135 837	312.215	136.341	315.116	136.866	318.031	137.413	320.961	137.980	323.905	138.568	170	
155	267.935	121.685	270.738	122.075	273.559	122.488	276.396	122.924	279.250	123.383	282.121	123.866	285.008	124.372	287.911	124.901	290.830	125.453	293.765	126.028	296.716	126.625	299.682	127.246	302.663	127.890	155	65 (P)*
125	224.832	99.442	227.702	99.924	230.593	100.434	233.503	100.973	236.433	101.541	239.382	102.137	242.351	102.761	245.339	103.414	248.345	104.094	251.369	104.803	254.412	105.540	257.473	106.304	260.551	107.096	125	
100	189.146	81.233	192.098	81.832	195.074	82.467	198.073	83.137	201.096	83.843	204.141	84.583	207.208	85.357	210.296	86.166	213.406	87.009	216.537	87.887	219.688	88.798	222.859	89.742	226.050	90.720	100	
90	174.970	74.091	177.965	74.755	180.986	75.458	184.032	76.200	187.103	76.981	190.198	77.799	193.316	78.656	196.457	79.550	199.620	80.481	202.805	81.450	206.011	82.455	209.237	83.497	212.484	84.575	90	50 (P)
80	160.876	67.074	163.924	67.818	166.999	68.606	170.102	69.436	173.230	70.309	176.383	71.225	179.562	72.182	182.764	73.180	185.989	74.220	189.236	75.300	192.505	76.420	195.795	77.580	199.105	78.779	80	50 (H)**
70	146.898	60.234	150.009	61.080	153.150	61.974	156.320	62.916	159.517	63.906	162.740	64.942	165.989	66.025	169.263	67.154	172.560	68.328	175.880	69.547	179.220	70.809	182.582	72.115	185.962	73.464	70	
60	133.080	53.654	136.270	54.632	139.492	55.665	142.743	56.752	146.022	57.892	149.329	59.084	152.661	60.329	156.017	61.624	159.396	62.969	162.797	64.362	166.217	65.804	169.655	67.292	173.111	68.827	60	40 (P)*
55	126.253	50.504	129.490	51.563	132.758	52.682	136.056	53.858	139.382	55.091	142.735	56.379	146.113	57.721	149.515	59.117	152.937	60.565	156.380	62.064	159.840	63.613	163.317	65.209	166.806	66.853	55	
50	119.497	47.480	122.785	48.636	126.104	49.854	129.453	51.134	132.830	52.474	136.233	53.872	139.658	55.328	143.106	56.840	146.572	58.405	150.055	60.023	153.554	61.692	157.065	63.410	160.587	65.176	50	40 (H)**
45	112.828	44.620	116.172	45.890	119.547	47.227	122.951	48.628	126.310	50.093	129.833	51.620	133.306	53.206	136.797	54.850	140.304	56.549	143.823	58.301	147.352	60.105	150.889	61.958	154.431	63.858	45	35 (P)*
40	106.264	41.979	109.670	43.385	113.104	44.862	116.563	46.407	120.044	48.018	123.544	49.694	127.060	51.430	130.587	53.224	134.124	55.074	137.665	56.976							40	30 (H)**
35	99.828	39.634	103.296	41.203	106.787	42.847	110.297	44.562	113.822	46.344	117.358	48.190															35	
33	97.294	38.803	100.785	40.447	104.296	42.165	107.823	43.955	111.360	45.813																	33	30 (P)*
30	93.536	37.699	97.058	39.465	100.593	41.305																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 112 Degrees

Δ=112°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
metre																												
2500	3713.901	1970.230	3716.406	1970.738	3718.911	1970.742	3721.418	1970.750	3723.926	1970.762	3726.435	1970.773	3728.946	1970.785	3731.458	1970.801	3733.970	1970.816	3736.484	1970.832	3739.000	1970.852	3741.517	1970.871	3744.034	1970.895	2500	
2200	3269.134	1734.245	3271.639	1734.251	3274.146	1734.259	3276.654	1734.269	3279.163	1734.280	3281.673	1734.292	3284.185	1734.307	3286.698	1734.323	3289.213	1734.341	3291.729	1734.360	3294.247	1734.381	3296.765	1734.404	3299.286	1734.428	2200	
2000	2972.623	1576.582	2975.129	1576.595	2977.636	1576.603	2980.144	1576.614	2982.655	1576.626	2985.166	1576.640	2987.679	1576.656	2990.194	1576.673	2992.710	1576.693	2995.227	1576.714	2997.747	1576.738	3000.268	1576.762	3002.790	1576.790	2000	
1800	2676.113	1418.931	2678.619	1418.939	2681.126	1418.948	2683.635	1418.959	2686.147	1418.973	2688.660	1418.989	2691.174	1419.006	2693.690	1419.026	2696.208	1419.047	2698.728	1419.071	2701.250	1419.097	2703.773	1419.125	2706.297	1419.155	1800	
1500	2231.347	1182.446	2233.854	1182.455	2236.363	1182.465	2238.874	1182.479	2241.388	1182.496	2243.903	1182.514	2246.420	1182.535	2248.940	1182.559	2251.462	1182.585	2253.985	1182.614	2256.511	1182.645	2259.039	1182.679	2261.568	1182.714	1500	
1200	1786.582	945.862	1789.091	945.973	1791.602	945.987	1794.116	946.004	1796.633	946.024	1799.152	946.048	1801.674	946.074	1804.198	946.104	1806.725	946.136	1809.254	946.172	1811.787	946.210	1814.321	946.252	1816.858	946.297	1200	
1000	1490.072	788.307	1492.583	788.320	1495.097	788.337	1497.614	788.357	1500.134	788.381	1502.657	788.409	1505.183	788.441	1507.712	788.477	1510.244	788.515	1512.780	788.558	1515.318	788.605	1517.859	788.655	1520.404	788.709	1000	
900	1341.818	709.480	1344.330	709.494	1346.845	709.513	1349.364	709.536	1351.886	709.562	1354.412	709.593	1356.941	709.629	1359.473	709.668	1362.010	709.712	1364.548	709.759	1367.091	709.811	1369.637	709.867	1372.187	709.927	900	
800	1193.564	630.653	1196.077	630.669	1198.595	630.690	1201.116	630.716	1203.641	630.746	1206.169	630.781	1208.702	630.821	1211.239	630.865	1213.779	630.914	1216.323	630.967	1218.871	631.025	1221.423	631.088	1223.978	631.156	800	
700	1045.311	551.827	1047.826	551.846	1050.345	551.869	1052.870	551.899	1055.399	551.934	1057.931	551.973	1060.469	552.019	1063.010	552.069	1065.556	552.125	1068.107	552.186	1070.661	552.253	1073.220	552.325	1075.783	552.402	700	100 (P)*
660	897.658	473.002	899.576	473.024	902.099	473.052	904.627	473.086	907.160	473.126	909.699	473.173	912.242	473.226	914.791	473.284	917.344	473.349	919.903	473.421	922.467	473.499	925.036	473.583	927.609	473.673	660	
500	748.807	394.179	751.328	394.205	753.856	394.238	756.390	394.279	758.930	394.327	761.476	394.383	764.028	394.447	766.586	394.517	769.150	394.595	771.720	394.682	774.296	394.775	776.879	394.875	779.467	394.983	500	
400	600.558	315.358	603.085	315.391	605.619	315.433	608.162	315.484	610.711	315.544	613.269	315.614	615.833	315.693	618.406	315.782	620.986	315.879	623.574	315.987	626.168	316.103	628.771	316.229	631.381	316.363	400	
360	541.260	283.831	543.790	283.867	546.328	283.914	548.875	283.971	551.430	284.038	553.993	284.115	556.565	284.204	559.146	284.302	561.735	284.410	564.332	284.529	566.937	284.658	569.551	284.798	572.172	284.948	360	
320	526.435	275.949	528.966	275.987	531.505	276.035	534.053	276.093	536.610	276.162	539.176	276.242	541.750	276.333	544.333	276.434	546.924	276.545	549.523	276.668	552.132	276.801	554.748	276.944	557.374	277.099	320	80 (P)*
300	452.313	236.543	454.850	236.587	457.396	236.642	459.952	236.710	462.518	236.791	465.094	236.884	467.680	236.990	470.276	237.108	472.882	237.238	475.498	237.381	478.125	237.536	480.760	237.703	483.406	237.883	300	
250	378.195	197.140	380.738	197.192	383.293	197.259	385.860	197.341	388.439	197.437	391.031	197.549	393.634	197.676	396.249	197.817	398.876	197.974	401.514	198.145	404.165	198.331	406.826	198.532	409.500	198.748	250	
230	348.549	181.380	351.095	181.436	353.655	181.509	356.228	181.598	358.814	181.703	361.413	181.825	364.025	181.963	366.650	182.116	369.287	182.286	371.938	182.472	374.601	182.673	377.276	182.893	379.965	183.127	230	
200	304.081	157.742	306.635	157.807	309.203	157.891	311.787	157.993	314.385	158.114	316.999	158.254	319.627	158.412	322.271	158.589	324.928	158.784	327.600	158.998	330.287	159.230	332.988	159.481	335.703	159.751	200	
170	259.616	134.108	262.179	134.183	264.760	134.283	267.358	134.404	269.974	134.546	272.607	134.710	275.257	134.896	277.925	135.104	280.609	135.334	283.311	135.585	286.029	135.859	288.763	136.154	291.515	136.470	170	65 (P)*
155	237.386	122.593	239.955	122.677	242.543	122.485	245.150	122.617	247.777	122.774	250.423	122.954	253.087	123.158	255.770	123.386	258.472	123.637	261.192	123.913	263.930	124.213	266.687	124.536	269.461	124.883	155	
125	192.930	98.670	195.515	94.723	198.124	98.909	200.757	99.072	203.413	99.266	206.093	99.489	208.795	99.742	211.520	100.024	214.268	100.336	217.038	100.678	219.830	101.049	222.643	101.449	225.478	101.879	125	
100	155.893	76.997	158.500	79.127	161.135	79.294	163.800	79.499	166.494	79.741	169.216	80.019	171.967	80.335	174.745	80.688	177.550	81.077	180.383	81.503	183.242	81.965	186.127	82.464	189.038	82.999	100	
90	141.083	71.132	143.701	71.277	146.351	71.463	149.034	71.690	151.748	71.959	154.494	72.268	157.270	72.619	160.077	73.010	162.914	73.442	165.781	73.915	168.676	74.428	171.600	74.981	174.551	75.574	90	50 (P)*
80	126.376	63.273	128.908	63.436	131.377	63.645	134.281	63.900	137.021	64.202	139.796	64.550	142.605	64.944	145.447	65.384	148.323	65.869	151.230	66.399	154.170	66.975	157.140	67.596	160.141	68.261	80	50 (H)**
70	111.475	55.420	114.125	55.606	116.817	55.845	119.549	56.137	122.321	56.481	125.133	56.878	127.982	57.328	130.869	57.829	133.793	58.383	136.753	58.987	139.747	59.643	142.775	60.350	145.837	61.107	70	
60	96.681	47.577	99.356	47.794	102.078	48.072	104.847	48.413	107.661	48.814	110.520	49.277	113.423	49.800	116.368	50.393	119.353	51.026	122.379	51.728	125.443	52.490	128.544	53.309	131.682	54.186	60	40 (P)*
55	89.239	43.661	91.978	43.897	94.720	44.201	97.512	44.572	100.353	45.010	103.241	45.513	106.177	46.083	109.157	46.718	112.180	47.418	115.246	48.182	118.353	49.009	121.498	49.899	124.681	50.851	55	
50	81.900	39.750	84.608	40.010	87.372	40.344	90.191	40.751	93.064	41.232	95.987	41.785	98.961	42.411	101.982	43.107	105.050	43.874	108.162	44.711	111.317	45.617	114.513	46.590	117.747	47.631	50	40 (H)**
45	74.517	35.845	77.247	36.134	80.039	36.505	82.890	36.957	85.800	37.491	88.765	38.104	91.784	38.796	94.854	39.567	97.974	40.416	101.140	41.340	104.351	42.340	107.604	43.414	110.897	44.559	45	35 (P)*
40	67.141	31.990	69.898	32.275	72.724	32.692	75.613	33.200	78.570	33.798	81.595	34.486	84.659	35.261	87.788	36.124	90.968	37.072	94.198	38.105	97.473	39.219	100.792	40.414	104.149	41.687	40	35 (H) 30 (P)*
35	59.735	28.068	62.366	28.439	65.035	28.915	68.376	29.494	71.388	30.175	74.465	30.957	77.605	31.838	80.803	32.817	84.056	33.890	87.359	35.056	90.709	36.313	94.101	37.657	97.530	39.086	35	
33	56.832	26.521	59.640	24.914	62.529	27.418	65.494	28.031	68.532	28.752	71.638	29.579	74.809	30.511	78.039	31.544	81.324	32.677	84.660	33.906	88.042	35.230	91.465	36.643	94.924	38.145	33	
30	52.423	24.206	55.260	24.638	58.184	25.191	61.189	25.864	64.272	26.655	67.427	27.560	70.648	28.578	73.931	29.706	77.269	30.941	80.658	32.277	84.090	33.719	87.561	35.244	91.063	36.865	30	30 (H)**
25	45.096	20.976	47.994	20.893	50.991	21.553	54.081	22.355	57.256	23.295	60.509	24.368	63.831	25.571	67.215	26.898	70.651	28.341	74.132	29.902	77.648	31.566	81.192	33.331	84.755	35.188	25	
23	42.174	18.857	45.103	19.418	48.138	20.134	51.270	21.002	54.489	22.018	57.788	23.176	61.156	24.471	64.584	25.897	68.061	27.445	71.578	29.110	75.123	30.882	78.688	32.755			23	25 (P)*
20	37.806	16.600	40.793	17.243	43.894	18.062	47.099	19.052	50.396	20.207	53.772	21.518	57.214	22.978	60.709	24.577	64.243	26.305	67.804	28.150							20	25 (H)**
15	30.595	12.932	33.715	13.780	36.966	14.853	40.329	16.139	43.780	17.622	47.296	19.286	50.853	21.113													15	20 (P)*
14	29.167	12.221	32.321	13.127	35.611	14.269	39.012	15.634	42.496	17.204	46.037	18.957															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 112 Degrees

$\Delta = 112°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	T_s	L_c	metre	
2500	3746.553	1970.914	3749.073	1970.941	3751.595	1970.968	3754.118	1970.992	3756.642	1971.023	3759.167	1971.055	3761.694	1971.086	3764.221	1971.121	3766.750	1971.152	3769.281	1971.191	3771.812	1971.230	3774.344	1971.270	3776.878	1971.309	2500	
2200	3301.807	1794.455	3304.330	1734.483	3306.855	1734.512	3309.381	1734.544	3311.908	1734.577	3314.437	1734.611	3316.967	1734.648	3319.498	1734.686	3322.031	1734.726	3324.565	1734.767	3327.101	1734.811	3329.638	1734.855	3332.176	1734.902	2200	
2000	3005.314	1576.818	3007.839	1576.849	3010.366	1576.882	3012.894	1576.916	3015.424	1576.952	3017.956	1576.991	3020.489	1577.031	3023.023	1577.073	3025.560	1577.117	3028.097	1577.162	3030.636	1577.210	3033.177	1577.259	3035.719	1577.310	2000	
1800	2708.824	1419.187	2711.352	1419.221	2713.882	1419.257	2716.414	1419.296	2718.947	1419.336	2721.482	1419.378	2724.018	1419.423	2726.557	1419.469	2729.097	1419.518	2731.638	1419.569	2734.182	1419.622	2736.727	1419.677	2739.274	1419.733	1800	
1500	2264.100	1182.753	2266.634	1182.794	2269.170	1182.838	2271.708	1182.883	2274.247	1182.932	2276.789	1182.982	2279.333	1183.036	2281.879	1183.092	2284.427	1183.150	2286.977	1183.211	2289.529	1183.275	2292.083	1183.340	2294.639	1183.409	1500	
1200	1819.398	946.345	1821.940	946.397	1824.485	946.451	1827.032	946.508	1829.582	946.569	1832.134	946.633	1834.689	946.699	1837.246	946.769	1839.806	946.842	1842.369	946.918	1844.933	946.997	1847.501	947.080	1850.071	947.165	1200	
1000	1522.951	788.767	1525.502	788.828	1528.055	788.893	1530.612	788.962	1533.172	789.035	1535.734	789.111	1538.300	789.192	1540.869	789.275	1543.440	789.363	1546.015	789.454	1548.593	789.549	1551.174	789.648	1553.757	789.750	1000	
900	1374.739	709.991	1377.295	710.059	1379.855	710.132	1382.417	710.208	1384.984	710.289	1387.553	710.374	1390.126	710.463	1392.702	710.556	1395.282	710.653	1397.865	710.754	1400.451	710.860	1403.040	710.969	1405.633	711.083	900	
800	1226.532	631.228	1229.100	631.305	1231.667	631.386	1234.238	631.472	1236.812	631.563	1239.390	631.659	1241.972	631.759	1244.558	631.864	1247.147	631.973	1249.740	632.087	1252.337	632.206	1254.938	632.329	1257.542	632.457	800	
700	1078.351	552.484	1080.923	552.572	1083.500	552.665	1086.080	552.763	1088.665	552.867	1091.254	552.976	1093.847	553.091	1096.445	553.211	1099.047	553.335	1101.653	553.466	1104.263	553.601	1106.878	553.742	1109.496	553.889	700	
600	930.188	473.769	932.772	473.871	935.360	473.980	937.954	474.095	940.553	474.216	943.156	474.343	945.765	474.476	948.379	474.616	950.997	474.762	953.620	474.914	956.249	475.072	958.882	475.236	961.520	475.407	600	
500	782.061	395.099	784.661	395.221	787.267	395.352	789.880	395.490	792.498	395.635	795.122	395.788	797.751	395.947	800.387	396.115	803.029	396.290	805.676	396.472	808.329	396.662	810.988	396.859	813.653	397.064	500	
450	633.998	316.508	636.623	316.661	639.254	316.824	641.894	316.997	644.541	317.178	647.195	317.368	649.856	317.568	652.525	317.778	655.200	317.996	657.884	318.224	660.574	318.461	663.271	318.708	665.976	318.963	450	
360	574.802	285.109	577.440	285.279	580.087	285.460	582.741	285.651	585.403	285.853	588.074	286.065	590.753	286.287	593.439	286.519	596.134	286.762	598.836	287.015	601.547	287.279	604.265	287.552	606.991	287.835	360	100 (P)*
350	560.087	277.263	562.649	277.439	565.299	277.625	567.958	277.822	570.623	278.029	573.301	278.247	575.984	278.475	578.676	278.715	581.375	278.964	584.083	279.224	586.800	279.495	589.524	279.776	592.257	280.068	350	
300	486.061	238.076	488.726	238.280	491.400	238.497	494.085	238.727	496.778	238.968	499.482	239.222	502.194	239.489	504.917	239.768	507.648	240.058	510.389	240.362	513.140	240.677	515.900	241.005	518.669	241.346	300	
250	412.185	198.978	414.882	199.224	417.590	199.484	420.310	199.759	423.040	200.049	425.782	200.353	428.536	200.673	431.300	201.007	434.075	201.355	436.862	201.719	439.659	202.097	442.468	202.490	445.286	202.898	250	
230	382.665	183.378	385.378	183.645	388.104	183.927	390.841	184.226	393.591	184.541	396.353	184.872	399.127	185.219	401.913	185.582	404.711	185.960	407.520	186.355	410.342	186.765	413.175	187.193	416.020	187.635	230	
200	338.432	160.039	341.176	160.345	343.933	160.670	346.704	161.014	349.490	161.375	352.288	161.755	355.100	162.154	357.927	162.571	360.766	163.006	363.618	163.459	366.484	163.931	369.363	164.420	372.254	164.928	200	80 (P)*
175	294.282	136.809	297.066	137.169	299.866	137.531	302.682	137.954	305.514	138.379	308.361	138.825	311.224	139.293	314.102	139.782	316.996	140.293	319.905	140.825	322.829	141.378	325.767	141.953	328.720	142.548	175	
155	272.252	125.254	275.062	125.649	277.889	126.067	280.733	126.509	283.594	126.974	286.472	127.463	289.367	127.976	292.279	128.511	295.207	129.071	298.150	129.653	301.111	130.258	304.086	130.887	307.078	131.539	155	65 (P)*
125	228.335	102.337	231.212	102.825	234.111	103.342	237.029	103.888	239.968	104.463	242.927	105.067	245.905	105.699	248.903	106.360	251.920	107.050	254.956	107.768	258.010	108.514	261.082	109.288	264.173	110.090	125	
100	181.974	83.571	184.936	84.178	197.921	84.821	200.931	85.500	203.965	86.214	207.021	86.964	210.100	87.748	213.202	88.568	216.325	89.422	219.469	90.310	222.635	91.233	225.820	92.190	229.026	93.180	100	
90	177.530	76.208	180.536	76.880	183.568	77.593	186.626	78.344	189.709	79.135	192.816	79.964	195.948	80.831	199.103	81.737	202.281	82.681	205.481	83.662	208.702	84.680	211.945	85.735	215.208	86.827	90	50 (P)
80	163.172	68.971	166.231	69.725	169.319	70.523	172.434	71.364	175.575	72.248	178.743	73.175	181.936	74.145	185.154	75.156	188.396	76.209	191.660	77.303	194.946	78.438	198.254	79.613	201.583	80.828	80	50 (H)**
70	148.930	61.914	152.055	62.771	155.210	63.676	158.394	64.631	161.606	65.633	164.846	66.683	168.112	67.780	171.403	68.923	174.719	70.113	178.057	71.347	181.418	72.626	184.800	73.948	188.201	75.314	70	
60	134.854	55.120	138.059	56.111	141.297	57.157	144.565	58.258	147.862	59.413	151.187	60.621	154.539	61.881	157.915	63.193	161.315	64.555	164.737	65.967	168.180	67.427	171.642	68.934	175.121	70.488	60	40 (P)*
55	127.900	51.864	131.153	52.938	134.438	54.071	137.755	55.262	141.100	56.511	144.473	57.815	147.872	59.175	151.295	60.589	154.741	62.056	158.207	63.574	161.691	65.143	165.193	66.760	168.710	68.425	55	
50	121.018	48.737	124.324	49.898	127.663	51.142	131.032	52.439	134.429	53.796	137.854	55.212	141.302	56.687	144.773	58.218	148.264	59.803	151.772	61.442	155.297	63.133	158.835	64.873	162.384	66.661	50	40 (H)**
45	114.226	45.776	117.590	47.062	120.986	48.416	124.412	49.836	127.864	51.320	131.341	52.866	134.839	54.473	138.356	56.138	141.889	57.859	145.435	59.634	148.993	61.461	152.558	63.338	156.129	65.262	45	33 (P)*
40	107.344	43.037	110.971	44.461	114.428	45.956	117.911	47.522	121.418	49.154	124.944	50.851	128.487	52.609	132.042	54.427	135.607	56.300	139.179	58.227							40	30 (H)**
35	100.993	40.597	104.485	42.186	108.002	43.851	111.539	45.588	115.092	47.393	118.656	49.263															35	
33	98.814	39.729	101.931	41.394	105.469	43.135	109.024	44.948	112.590	46.829																	33	30 (P)*
30	94.592	38.573	98.142	40.361	101.705	42.225																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	23 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 113 Degrees

$\Delta = 113°$

R_C	L_S=15 metres		L_S=20 metres		L_S=25 metres		L_S=30 metres		L_S=35 metres		L_S=40 metres		L_S=45 metres		L_S=50 metres		L_S=55 metres		L_S=60 metres		L_S=65 metres		L_S=70 metres		L_S=75 metres		R_C	Speed km/h
	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
metre																												
3500	3784.587	2029.504	3787.092	2029.508	3789.598	2029.516	3792.104	2029.523	3794.613	2029.535	3797.122	2029.547	3799.633	2029.559	3802.145	2029.574	3804.658	2029.590	3807.172	2029.590	3809.688	2029.625	3812.205	2029.645	3814.723	2029.668	2500	
2200	3337.338	1785.965	3338.844	1785.972	3336.350	1785.979	3338.858	1785.989	3341.367	1786.000	3343.878	1786.013	3346.390	1786.027	3348.904	1786.044	3351.418	1786.062	3353.935	1786.081	3356.453	1786.103	3358.972	1786.126	3361.493	1786.151	2200	
2000	3029.173	1623.606	3031.678	1623.613	3034.183	1623.622	3036.694	1623.632	3039.204	1623.645	3041.716	1623.659	3044.229	1623.675	3046.744	1623.692	3049.260	1623.712	3051.779	1623.734	3054.299	1623.758	3056.820	1623.783	3059.342	1623.810	2000	
1840	2777.007	1461.268	2779.513	1461.255	2732.021	1461.264	2734.530	1461.276	2737.042	1461.290	2739.555	1461.305	2742.070	1461.323	2744.586	1461.343	2747.105	1461.365	2749.625	1461.389	2752.147	1461.416	2754.670	1461.444	2757.193	1461.474	1840	
1800	2275.799	1217.710	2276.266	1217.719	2278.775	1217.730	2281.287	1217.744	2283.801	1217.760	2286.316	1217.779	2288.834	1217.800	2291.354	1217.824	2293.876	1217.851	2296.400	1217.880	2298.926	1217.911	2301.454	1217.945	2303.985	1217.982	1800	
1700	1820.911	974.173	1823.000	974.184	1825.532	974.198	1828.047	974.216	1830.563	974.236	1833.083	974.260	1835.605	974.286	1838.130	974.316	1840.657	974.349	1843.188	974.385	1845.720	974.425	1848.255	974.467	1850.793	974.513	1700	
1600	1518.347	811.816	1520.850	811.829	1523.372	811.846	1525.890	811.867	1528.410	811.892	1530.933	811.920	1533.460	811.952	1535.990	811.988	1538.522	812.027	1541.058	812.071	1543.597	812.118	1546.140	812.169	1548.685	812.224	1600	
1500	1367.265	730.638	1369.778	730.653	1372.293	730.672	1374.812	730.695	1377.335	730.722	1379.861	730.753	1382.391	730.789	1384.924	730.829	1387.460	730.873	1390.000	730.921	1392.543	730.973	1395.091	731.030	1397.641	731.091	1500	
1400	1216.184	649.460	1218.698	649.477	1221.215	649.498	1223.737	649.524	1226.262	649.555	1228.792	649.590	1231.325	649.630	1233.862	649.675	1236.403	649.725	1238.948	649.779	1241.497	649.838	1244.050	649.901	1246.606	649.970	1400	
1300	1065.103	568.284	1067.619	568.303	1070.139	568.327	1072.664	568.356	1075.193	568.392	1077.726	568.432	1080.264	568.478	1082.807	568.529	1085.353	568.585	1087.905	568.648	1090.460	568.715	1093.021	568.788	1095.585	568.866	1300	100 (P)*
1200	914.023	487.108	916.542	487.120	919.065	487.138	921.594	487.193	924.127	487.233	926.667	487.281	929.211	487.334	931.760	487.394	934.315	487.460	936.875	487.532	939.440	487.611	942.010	487.696	944.585	487.787	1200	
1100	762.945	405.934	765.467	405.960	767.995	405.994	770.529	406.035	773.070	406.084	775.617	406.141	778.170	406.205	780.729	406.277	783.294	406.356	785.866	406.443	788.444	406.537	791.028	406.639	793.617	406.749	1100	
1000	611.868	324.762	614.396	324.795	616.931	324.838	619.474	324.889	622.025	324.951	624.583	325.022	627.149	325.102	629.723	325.192	632.304	325.290	634.894	325.399	637.491	325.517	640.095	325.644	642.707	325.781	1000	
900	551.439	292.295	553.970	292.332	556.509	292.379	559.056	292.437	561.613	292.505	564.177	292.583	566.751	292.672	569.333	292.772	571.923	292.882	574.522	293.002	577.129	293.133	579.745	293.275	582.369	293.427	900	
800	536.332	284.178	538.863	284.216	541.404	284.265	543.952	284.324	546.510	284.394	549.077	284.475	551.652	284.566	554.237	284.669	556.830	284.782	559.431	284.906	562.042	285.041	564.661	285.186	567.289	285.343	800	
700	460.797	243.596	463.333	243.641	465.880	243.697	468.437	243.766	471.005	243.848	473.583	243.942	476.171	244.049	478.769	244.169	481.376	244.301	483.995	244.445	486.624	244.603	489.262	244.772	491.910	244.954	700	80 (P)*
650	385.265	203.018	387.808	203.071	390.365	203.138	392.933	203.221	395.514	203.320	398.107	203.433	400.712	203.561	403.329	203.704	405.958	203.863	408.600	204.036	411.253	204.225	413.918	204.428	416.595	204.647	650	
620	355.053	186.780	357.600	186.845	360.161	186.919	362.736	187.009	365.323	187.116	367.924	187.239	370.539	187.378	373.166	187.534	375.806	187.706	378.459	187.895	381.125	188.100	383.804	188.321	386.496	188.558	620	
600	309.737	162.445	312.792	162.511	314.862	162.596	317.447	162.699	320.048	162.822	322.663	162.964	325.294	163.124	327.940	163.303	330.601	163.501	333.276	163.718	335.967	163.953	338.672	164.207	341.391	164.480	600	
580	286.424	138.106	266.969	138.183	269.571	138.283	272.171	138.405	274.789	138.550	277.425	138.716	280.078	138.905	282.749	139.115	285.437	139.348	288.142	139.603	290.865	139.880	293.604	140.178	296.360	140.499	580	65 (P)*
555	241.779	125.938	244.340	126.024	246.930	126.113	249.540	126.267	252.169	126.425	254.817	126.608	257.485	126.814	260.172	127.045	262.877	127.301	265.602	127.580	268.345	127.883	271.106	128.211	273.886	128.563	555	
525	196.467	101.611	199.053	101.716	201.665	101.852	204.300	102.018	206.959	102.214	209.642	102.440	212.348	102.698	215.078	102.983	217.831	103.299	220.606	103.645	223.404	104.020	226.224	104.426	229.066	104.861	525	
500	158.723	81.350	161.332	81.482	163.970	81.651	166.638	81.859	169.336	82.104	172.062	82.386	174.818	83.706	177.602	83.063	180.413	83.457	183.252	83.889	186.119	84.357	189.012	84.863	191.931	85.405	500	
480	143.631	73.251	146.250	73.397	148.994	73.586	151.590	73.816	154.309	74.088	157.059	74.402	159.841	74.757	162.655	75.153	165.498	75.591	168.372	76.070	171.276	76.589	174.208	77.150	177.169	77.751	480	50 (P)*
460	128.541	65.156	131.176	65.321	133.848	65.533	136.556	65.792	139.301	66.098	142.081	66.450	144.896	66.849	147.746	67.295	150.629	67.786	153.545	68.324	156.494	68.907	159.474	69.536	162.485	70.210	460	50 (H)**
440	113.458	57.068	116.111	57.257	118.806	57.499	121.543	57.795	124.321	58.144	127.139	58.546	129.995	59.002	132.890	59.510	135.823	60.070	138.792	60.683	141.797	61.347	144.836	62.063	147.909	62.830	440	
420	98.382	48.991	101.060	49.211	103.787	49.493	106.561	49.838	109.382	50.245	112.248	50.713	115.159	51.243	118.113	51.834	121.109	52.486	124.145	53.197	127.221	53.968	130.336	54.799	133.487	55.687	420	40 (P)*
400	90.849	44.958	93.542	45.197	96.288	45.505	99.086	45.881	101.934	46.324	104.831	46.835	107.775	47.412	110.765	48.055	113.800	48.764	116.878	49.538	119.997	50.376	123.157	51.278	126.355	52.243	400	
380	81.319	40.029	86.031	41.193	88.801	41.531	91.626	41.944	94.506	42.431	97.438	42.992	100.422	43.625	103.454	44.331	106.534	45.108	109.660	45.956	112.829	46.874	116.040	47.860	119.291	48.914	380	40 (H)**
360	73.795	36.004	78.530	37.201	81.327	37.577	84.186	38.035	87.104	38.575	90.079	39.196	93.109	39.898	96.191	40.679	99.324	41.539	102.505	42.475	105.732	43.488	109.002	44.576	112.313	45.737	360	35 (P)*
340	66.278	32.896	71.041	35.225	73.873	33.647	76.773	34.162	79.737	34.768	82.764	35.465	85.849	36.251	88.991	37.125	92.187	38.086	95.433	39.131	98.726	40.260	102.063	41.471	105.441	42.761	340	35 (H) 30 (P)*
320	60.772	28.697	63.569	29.273	66.445	29.755	69.396	30.341	72.418	31.032	75.508	31.824	78.662	32.717	81.875	33.708	85.145	34.796	88.467	35.977	91.836	37.250	95.249	38.612	98.701	40.060	320	
300	55.775	25.393	60.588	27.701	63.484	28.212	66.459	28.833	69.508	29.564	72.628	30.402	75.813	31.346	79.059	32.393	82.363	33.540	85.718	34.786	89.121	36.127	92.566	37.559	96.049	39.080	300	
280	52.280	24.919	56.124	25.347	59.056	25.917	62.073	26.599	65.168	27.399	68.337	28.317	71.575	29.348	74.875	30.491	78.233	31.742	81.642	33.096	85.097	34.551	88.592	36.102	92.121	37.744	280	30 (H)**
260	45.813	20.972	48.719	21.496	51.727	22.163	54.830	22.978	58.020	23.930	61.290	25.018	64.631	26.236	68.035	27.580	71.494	29.045	75.009	30.623	78.573	32.310	82.174	34.098	85.706	35.979	260	
240	42.836	19.407	45.774	19.975	48.820	20.701	51.965	21.581	55.201	22.610	58.518	23.783	61.907	25.095	65.357	26.539	68.859	28.108	72.402	29.795	75.975	31.591	79.570	33.488			240	25 (P)*
220	38.386	17.081	41.382	17.732	44.496	18.562	47.716	19.566	51.031	20.735	54.428	22.064	57.893	23.543	61.414	25.163	64.975	26.913	68.565	28.783							220	25 (H)**
200	33.936	15.299	36.878	15.818	40.036	15.246	43.296	16.548	46.651	18.051	50.096	19.737	53.624	21.587													200	20 (P)*
180	29.582	12.566	32.250	13.483	35.058	14.641	39.481	16.024	42.990	17.614	46.558	19.390															180	20 (H)**
160																											160	
140																											140	

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 113 Degrees

△=113°

R_C	L_S=80 metres		L_S=85 metres		L_S=90 metres		L_S=95 metres		L_S=100 metres		L_S=105 metres		L_S=110 metres		L_S=115 metres		L_S=120 metres		L_S=125 metres		L_S=130 metres		L_S=135 metres		L_S=140 metres		R_C	Speed km/h
metre	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	T_S	E_S	metre	
2500	3817.243	2029.591	3819.763	2029.715	3822.285	2029.742	3824.809	2029.770	3827.333	2029.801	3829.859	2029.832	3832.386	2029.863	3834.914	2029.898	3837.443	2029.934	3839.974	2029.969	3842.506	2030.008	3845.039	2030.047	3847.574	2030.090	2500	
2200	3360.015	1786.177	3366.538	1786.206	3369.063	1786.236	3371.590	1786.268	3374.118	1786.301	3376.646	1786.336	3379.177	1786.373	3381.709	1786.412	3384.243	1786.452	3386.778	1786.494	3389.314	1786.538	3391.852	1786.583	3394.390	1786.630	2200	
2000	3061.866	1623.840	3064.392	1623.871	3066.920	1623.904	3069.449	1623.939	3071.979	1623.975	3074.511	1624.014	3077.045	1624.055	3079.580	1624.097	3082.117	1624.142	3084.655	1624.188	3087.195	1624.236	3089.737	1624.286	3092.279	1624.338	2000	
1800	2759.722	1461.507	2762.251	1461.541	2764.781	1461.578	2767.314	1461.617	2769.847	1461.658	2772.383	1461.700	2774.920	1461.746	2777.460	1461.793	2780.000	1461.842	2782.543	1461.893	2785.087	1461.947	2787.633	1462.003	2790.181	1462.060	1800	
1500	2306.517	1218.021	2309.051	1218.062	2311.588	1218.106	2314.126	1218.153	2316.667	1218.202	2319.209	1218.253	2321.755	1218.308	2324.301	1218.364	2326.850	1218.423	2329.401	1218.485	2331.954	1218.549	2334.509	1218.615	2337.067	1218.685	1500	
1200	1853.333	974.561	1855.877	974.614	1858.422	974.668	1860.970	974.726	1863.521	974.788	1866.074	974.853	1868.630	974.920	1871.189	974.991	1873.750	975.065	1876.313	975.142	1878.879	975.222	1881.448	975.305	1884.020	975.392	1200	
1000	1551.233	812.282	1553.785	812.344	1556.340	812.410	1558.897	812.480	1561.458	812.554	1564.022	812.631	1566.589	812.712	1569.159	812.797	1571.732	812.886	1574.308	812.978	1576.887	813.075	1579.470	813.175	1582.055	813.278	1000	
900	1400.195	731.156	1402.752	731.225	1405.312	731.299	1407.876	731.376	1410.444	731.458	1413.015	731.544	1415.589	731.634	1418.167	731.728	1420.748	731.827	1423.332	731.929	1425.920	732.036	1428.511	732.147	1431.106	732.263	900	
800	1249.165	650.043	1251.731	650.121	1254.299	650.204	1256.871	650.291	1259.446	650.383	1262.026	650.479	1264.610	650.581	1267.197	650.687	1269.788	650.798	1272.383	650.914	1274.981	651.033	1277.584	651.159	1280.190	651.288	800	
700	1098.154	568.949	1100.727	569.038	1103.305	569.133	1105.887	569.232	1108.474	569.338	1111.064	569.448	1113.659	569.564	1116.259	569.685	1118.863	569.812	1121.471	569.944	1124.084	570.081	1126.700	570.224	1129.322	570.372	700	
600	947.163	487.885	949.750	487.989	952.341	488.099	954.937	488.215	957.537	488.337	960.143	488.466	962.753	488.602	965.369	488.743	967.990	488.891	970.616	489.045	973.247	489.205	975.883	489.372	978.523	489.544	600	
500	796.213	406.865	798.815	406.990	801.424	407.122	804.038	407.262	806.658	407.409	809.285	407.563	811.917	407.726	814.555	407.895	817.200	408.073	819.850	408.257	822.506	408.449	825.168	408.649	827.836	408.856	500	
400	645.327	325.927	647.954	326.083	650.588	326.248	653.231	326.422	655.880	326.606	658.537	326.799	661.201	327.002	663.874	327.214	666.552	327.435	669.239	327.666	671.933	327.906	674.635	328.156	677.343	328.415	400	
360	585.002	293.589	587.643	293.762	590.292	293.945	592.949	294.139	595.615	294.343	598.289	294.558	600.971	294.783	603.661	295.019	606.360	295.264	609.066	295.521	611.781	295.788	614.504	296.064	617.234	296.352	360	100 (P)*
350	569.925	285.509	572.570	285.687	575.223	285.875	577.885	286.075	580.555	286.285	583.234	286.506	585.921	286.737	588.616	286.980	591.320	287.232	594.032	287.496	596.753	287.771	599.482	288.055	602.219	288.351	350	
300	494.568	245.149	497.236	245.356	499.914	245.576	502.603	245.809	505.300	246.053	508.007	246.311	510.724	246.581	513.451	246.864	516.187	247.158	518.933	247.465	521.688	247.785	524.453	248.117	527.228	248.462	300	
250	419.284	204.881	421.985	205.129	424.697	205.393	427.421	205.671	430.156	205.965	432.903	206.274	435.661	206.597	438.431	206.936	441.212	207.289	444.004	207.657	446.807	208.041	449.622	208.439	452.447	208.852	250	
230	389.201	188.812	391.918	189.082	394.648	189.369	397.391	189.671	400.145	189.990	402.912	190.326	405.692	190.677	408.484	191.045	411.288	191.429	414.103	191.829	416.931	192.245	419.771	192.677	422.623	193.126	230	80 (P)*
200	344.125	164.772	346.873	165.083	349.635	165.412	352.412	165.760	355.203	166.126	358.008	166.511	360.826	166.915	363.659	167.337	366.505	167.778	369.365	168.237	372.238	168.715	375.124	169.211	378.024	169.726	200	
170	295.133	140.842	301.923	141.207	304.729	141.594	307.551	142.002	310.389	142.433	313.244	142.885	316.114	143.359	319.000	143.855	321.902	144.372	324.819	144.911	327.752	145.471	330.699	146.053	333.662	146.657	170	
155	276.684	128.938	279.499	129.338	282.333	129.762	285.184	130.210	288.052	130.681	290.938	131.177	293.841	131.696	296.761	132.239	299.698	132.805	302.651	133.395	305.621	134.008	308.606	134.645	311.608	135.306	155	65 (P)*
125	231.929	103.326	234.814	105.820	237.721	106.344	240.648	106.897	243.596	107.480	246.564	108.091	249.553	108.732	252.561	109.402	255.589	110.100	258.636	110.828	261.702	111.583	264.787	112.368	267.890	113.180	125	
100	194.877	83.984	197.848	86.599	200.844	87.251	203.864	87.938	206.909	88.662	209.977	89.421	213.069	90.216	216.183	91.047	219.320	91.912	222.478	92.812	225.658	93.747	228.859	94.717	232.080	95.720	100	
90	180.158	78.393	183.175	79.074	186.218	79.796	189.288	80.557	192.383	81.358	195.504	82.198	198.649	83.077	201.818	83.995	205.011	84.951	208.226	85.945	211.464	86.976	214.724	88.046	218.004	89.152	90	50 (P)
80	165.527	70.930	168.598	71.693	171.698	72.502	174.827	73.354	177.983	74.250	181.165	75.189	184.374	76.171	187.607	77.196	190.865	78.263	194.147	79.371	197.452	80.521	200.778	81.711	204.126	82.942	80	50 (H)**
70	151.016	63.648	154.154	64.516	157.323	65.434	160.523	66.400	163.751	67.416	167.007	68.480	170.290	69.591	173.600	70.750	176.934	71.954	180.292	73.205	183.673	74.501	187.076	75.841	190.499	77.224	70	
60	136.674	56.634	139.895	57.637	143.149	58.697	146.435	59.812	149.750	60.982	153.094	62.206	156.466	63.483	159.863	64.812	163.285	66.192	166.729	67.623	170.195	69.102	173.680	70.629	177.184	72.204	60	40 (P)*
55	129.589	53.269	132.859	54.357	136.161	55.505	139.498	56.712	142.863	57.977	146.257	59.299	149.678	60.676	153.123	62.109	156.591	63.595	160.081	65.133	163.591	66.722	167.118	68.361	170.661	70.047	55	
50	122.579	50.035	125.904	51.221	129.262	52.472	132.651	53.785	136.071	55.160	139.517	56.596	142.989	58.089	146.484	59.640	150.000	61.247	153.534	62.907	157.085	64.620	160.651	66.383	164.229	68.195	50	40 (H)**
45	115.661	46.970	119.046	48.273	122.463	49.644	125.911	51.083	129.387	52.586	132.888	54.153	136.412	55.781	139.955	57.467	143.515	59.211	147.089	61.010	150.676	62.861	154.271	64.762	157.873	66.711	45	35 (P)*
40	108.856	44.128	112.306	45.521	115.787	47.086	119.295	48.672	122.827	50.326	126.380	52.045	129.951	53.827	133.535	55.668	137.130	57.566	140.732	59.519							40	30 (H)**
35	102.188	41.591	105.705	43.201	109.248	44.888	112.813	46.647	116.395	48.476	119.989	50.370															35	
33	99.564	40.685	103.107	42.372	106.673	44.136	110.256	45.973	113.852	47.879																	33	30 (P)*
30	95.617	39.474	99.254	41.286	102.847	43.175																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 114 Degrees

$\Delta = 114°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3457.160	2090.195	3859.664	2090.203	3862.170	2090.207	3864.677	2090.219	3867.186	2090.227	3869.695	2090.238	3872.206	2090.250	3874.719	2090.266	3877.232	2090.281	3879.746	2090.301	3882.262	2090.320	3884.780	2090.340	3887.298	2090.363	2500	
2250	3090.202	1839.374	3397.707	1839.381	3400.214	1839.388	3402.722	1839.398	3405.231	1839.409	3407.742	1839.422	3410.255	1839.437	3412.769	1839.454	3415.284	1839.472	3417.800	1839.492	3420.319	1839.514	3422.838	1839.537	3425.359	1839.562	2250	
2000	3087.230	1672.160	3089.736	1672.167	3092.243	1672.175	3094.752	1672.186	3097.263	1672.199	3099.775	1672.213	3102.288	1672.229	3104.803	1672.247	3107.320	1672.267	3109.839	1672.289	3112.359	1672.313	3114.880	1672.339	3117.403	1672.367	2000	
1800	2779.259	1504.946	2781.765	1504.953	2784.273	1504.963	2786.783	1504.975	2789.295	1504.989	2791.808	1505.005	2794.323	1505.022	2796.840	1505.043	2799.359	1505.065	2801.879	1505.089	2804.402	1505.116	2806.925	1505.145	2809.451	1505.175	1800	
1500	2317.302	1254.125	2319.810	1254.134	2322.319	1254.146	2324.831	1254.159	2327.345	1254.176	2329.861	1254.195	2332.379	1254.217	2334.899	1254.241	2337.422	1254.268	2339.946	1254.297	2342.473	1254.329	2345.001	1254.364	2347.532	1254.401	1500	
1200	1855.346	1003.305	1857.855	1003.316	1860.367	1003.331	1862.882	1003.348	1865.399	1003.369	1867.919	1003.393	1870.442	1003.420	1872.968	1003.450	1875.495	1003.484	1878.026	1003.521	1880.559	1003.560	1883.095	1003.603	1885.634	1003.650	1200	
1000	1547.376	836.093	1549.887	836.106	1552.402	836.124	1554.920	836.145	1557.440	836.169	1559.964	836.198	1562.491	836.231	1565.022	836.267	1567.555	836.307	1570.092	836.351	1572.632	836.399	1575.175	836.450	1577.721	836.506	1000	
900	1393.392	752.488	1395.904	752.502	1398.420	752.521	1400.939	752.545	1403.462	752.572	1405.989	752.604	1408.519	752.640	1411.053	752.681	1413.591	752.726	1416.131	752.774	1418.675	752.827	1421.223	752.885	1423.774	752.947	900	
800	1239.407	668.882	1241.921	668.899	1244.439	668.920	1246.961	668.947	1249.487	668.978	1252.017	669.013	1254.551	669.054	1257.089	669.100	1259.631	669.150	1262.177	669.205	1264.726	669.264	1267.280	669.329	1269.838	669.398	800	
700	1085.424	585.278	1087.940	585.297	1090.460	585.321	1092.985	585.351	1095.515	585.387	1098.049	585.428	1100.588	585.475	1103.131	585.526	1105.679	585.583	1108.231	585.647	1110.788	585.715	1113.350	585.789	1115.915	585.868	700	100 (P)*
600	931.441	501.674	933.960	501.697	936.484	501.725	939.013	501.760	941.547	501.802	944.087	501.849	946.633	501.904	949.183	501.964	951.738	502.031	954.300	502.104	956.866	502.184	959.437	502.270	962.014	502.363	600	
500	777.460	418.073	779.982	418.099	782.511	418.133	785.046	418.176	787.587	418.225	790.135	418.283	792.689	418.348	795.249	418.420	797.816	418.500	800.389	418.589	802.968	418.684	805.554	418.787	808.146	418.898	500	
400	623.481	334.473	626.009	334.507	628.545	334.550	631.088	334.603	633.640	334.665	636.200	334.737	638.767	334.818	641.343	334.909	643.925	335.009	646.517	335.119	649.115	335.238	651.721	335.367	654.336	335.506	400	
360	561.890	301.035	564.421	301.073	566.961	301.120	569.510	301.179	572.067	301.248	574.633	301.327	577.208	301.418	579.792	301.519	582.384	301.630	584.985	301.752	587.594	301.885	590.212	302.028	592.839	302.182	360	
320	546.493	292.676	549.025	292.714	551.566	292.763	554.116	292.823	556.675	292.894	559.243	292.976	561.820	293.069	564.406	293.173	567.000	293.288	569.604	293.413	572.217	293.550	574.838	293.697	577.468	293.856	320	
300	469.506	250.880	472.044	250.925	474.592	250.982	477.150	251.052	479.719	251.135	482.298	251.231	484.887	251.339	487.487	251.460	490.097	251.594	492.718	251.740	495.349	251.900	497.990	252.072	500.641	252.256	300	80 (P)*
250	392.523	209.088	395.068	209.141	397.625	209.210	400.195	209.294	402.777	209.394	405.372	209.509	407.979	209.638	410.598	209.784	413.230	209.944	415.875	210.120	418.531	210.311	421.199	210.517	423.880	210.739	250	
230	361.731	192.372	364.279	192.430	366.841	192.505	369.417	192.597	372.006	192.705	374.609	192.830	377.226	192.971	379.855	193.129	382.499	193.303	385.155	193.494	387.824	193.702	390.507	193.926	393.203	194.167	230	
200	313.544	167.301	318.100	167.368	320.671	167.454	323.258	167.559	325.861	167.684	328.479	167.827	331.112	167.990	333.761	168.171	336.425	168.372	339.104	168.591	341.798	168.830	344.507	169.087	347.231	169.364	200	
170	269.361	142.234	271.926	142.313	274.310	142.414	277.112	142.538	279.732	142.684	282.371	142.853	285.027	143.044	287.701	143.257	290.393	143.493	293.103	143.751	295.829	144.032	298.574	144.335	301.335	144.660	170	65 (P)*
155	246.271	129.703	248.843	129.789	251.434	129.900	254.046	130.036	256.678	130.196	259.329	130.381	262.000	130.591	264.691	130.824	267.400	131.083	270.129	131.366	272.877	131.674	275.644	132.006	278.429	132.362	155	
125	200.097	106.447	202.686	106.754	205.299	104.892	207.937	105.060	210.600	105.259	213.286	105.488	215.997	105.747	218.731	106.037	221.488	106.358	224.269	106.708	227.073	107.089	229.900	107.500	232.748	107.941	125	
100	161.629	83.780	164.239	83.913	166.880	84.085	169.552	84.296	172.253	84.544	174.985	84.830	177.745	85.154	180.535	85.516	183.353	85.916	186.199	86.355	189.073	86.828	191.974	87.340	194.902	87.889	100	
90	146.246	75.438	148.868	75.587	151.525	75.778	154.215	76.011	156.938	76.287	159.693	76.604	162.481	76.964	165.301	77.366	168.152	77.810	171.033	78.295	173.945	78.822	176.886	79.390	179.857	79.999	90	50 (P)*
80	130.867	67.101	133.504	67.268	136.160	67.483	138.892	67.746	141.642	68.056	144.428	68.413	147.249	68.817	150.106	69.268	152.997	66.797	155.922	70.311	158.880	70.903	161.870	71.540	164.892	72.223	80	50 (H)**
70	115.494	58.771	118.150	58.962	120.849	59.203	123.591	59.507	126.374	59.861	129.198	60.269	132.062	60.730	134.965	61.245	137.907	61.813	140.886	62.434	143.901	63.107	146.952	63.833	150.038	64.610	70	
60	100.128	50.451	102.810	50.674	105.541	50.960	108.321	51.310	111.148	51.722	114.022	52.197	116.941	52.734	119.905	53.332	122.911	53.993	125.959	54.714	129.047	55.496	132.175	56.337	135.341	57.237	60	40 (P)*
55	92.450	46.297	95.147	46.540	97.899	46.852	100.702	47.233	103.557	47.682	106.462	48.199	109.416	48.784	112.416	49.436	115.462	50.154	118.553	50.939	121.685	51.788	124.859	52.702	128.073	53.680	55	
50	84.776	42.148	87.492	42.415	90.267	42.758	93.099	43.176	95.987	43.670	98.928	44.238	101.922	44.880	104.966	45.595	108.038	46.383	111.197	47.242	114.381	48.172	117.608	49.171	120.876	50.240	50	40 (H)**
45	77.107	38.006	79.847	38.302	82.650	38.683	85.517	39.147	88.443	39.695	91.428	40.324	94.469	41.035	97.564	41.827	100.711	42.698	103.907	43.647	107.150	44.674	110.437	45.776	113.766	46.953	45	35 (P)**
40	69.446	33.873	72.214	34.206	75.053	34.634	77.961	35.156	80.935	35.770	83.973	36.476	87.071	37.273	90.227	38.158	93.438	39.132	96.701	40.192	100.012	41.336	103.368	42.563	106.767	43.870	40	35 (H) 30 (P)*
36	61.796	29.754	64.399	30.134	67.483	30.623	70.443	31.217	73.476	31.916	76.579	32.719	79.747	33.624	82.976	34.629	86.264	35.731	89.604	36.928	92.994	38.218	96.429	39.599	99.904	41.066	35	
33	58.739	28.111	61.560	28.515	64.465	29.032	67.450	29.662	70.511	30.402	73.643	31.251	76.844	32.208	80.107	33.269	83.429	34.432	86.804	35.694	90.228	37.053	93.696	38.504	97.204	40.046	33	
30	54.160	25.655	57.011	26.098	59.952	26.666	62.979	27.357	66.088	28.168	69.271	29.098	72.525	30.144	75.844	31.302	79.222	32.569	82.653	33.942	86.132	35.416	89.651	36.988	93.206	38.652	30	30 (H)**
25	46.550	21.588	49.464	22.119	52.483	22.797	55.599	23.621	58.804	24.586	62.091	25.688	65.452	26.922	68.878	28.285	72.360	29.769	73.891	31.369	79.461	33.078	83.061	34.889	86.683	36.796	25	
23	43.516	19.975	46.462	20.551	49.520	21.287	52.680	22.178	55.932	23.221	59.268	24.410	62.678	25.740	66.151	27.203	69.678	28.793	73.248	30.502	76.850	32.322	80.475	34.245			23	25 (P)*
20	38.980	17.578	41.986	18.238	45.114	19.079	48.350	20.096	51.684	21.281	55.102	22.628	58.591	24.127	62.137	25.768	65.727	27.542	69.347	29.437							20	25 (H)**
15	31.490	13.678	34.626	14.549	37.922	15.651	41.327	16.971	44.826	18.494	48.395	20.202	52.010	22.078													15	20 (P)*
14	30.008	12.922	33.191	13.851	36.517	15.025	39.962	16.426	43.496	18.038	47.093	19.838															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

$\Delta = 114^{c}$

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 114 Degrees

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3839.818	2090.387	3892.339	2090.410	3894.862	2090.438	3897.385	2090.465	3899.910	2090.496	3902.437	2090.527	3904.964	2090.559	3907.493	2090.594	3910.022	2090.629	3912.554	2090.668	3915.087	2090.707	3917.620	2090.746	3920.156	2090.789	2500	
2400	3427.882	1839.589	3430.406	1839.618	3432.931	1839.648	3435.458	1839.680	3437.987	1839.715	3440.516	1839.750	3443.047	1839.788	3445.580	1839.827	3448.114	1839.867	3450.650	1839.910	3453.187	1839.954	3455.725	1840.000	3458.265	1840.048	2400	
2300	3119.928	1672.396	3122.455	1672.428	3124.982	1672.461	3127.512	1672.497	3130.043	1672.534	3132.576	1672.573	3135.110	1672.615	3137.646	1672.657	3140.184	1672.702	3142.723	1672.749	3145.263	1672.798	3147.805	1672.849	3150.349	1672.901	2300	
2200	2811.979	1505.208	2814.508	1505.243	2817.039	1505.281	2819.572	1505.320	2822.106	1505.361	2824.642	1505.405	2827.180	1505.451	2829.720	1505.499	2832.262	1505.548	2834.805	1505.600	2837.350	1505.655	2839.897	1505.711	2842.446	1505.769	2200	
2100	2350.065	1254.440	2352.600	1254.482	2355.138	1254.527	2357.677	1254.574	2360.219	1254.624	2362.762	1254.676	2365.306	1254.731	2367.855	1254.788	2370.405	1254.848	2372.957	1254.911	2375.511	1254.976	2378.067	1255.043	2380.626	1255.113	2100	
2000	1888.175	1003.699	1890.719	1003.752	1893.265	1003.807	1895.814	1003.866	1898.366	1003.928	1900.920	1003.994	1903.477	1004.063	1906.037	1004.134	1908.599	1004.209	1911.164	1004.287	1913.731	1004.368	1916.301	1004.453	1918.874	1004.540	2000	
1900	1580.270	836.565	1582.823	836.628	1585.378	836.695	1587.937	836.766	1590.499	836.841	1593.064	836.919	1595.632	837.001	1598.204	837.087	1600.778	837.177	1603.356	837.271	1605.937	837.369	1608.521	837.470	1611.107	837.575	1900	
1800	1426.329	751.012	1428.887	753.082	1431.449	753.157	1434.014	753.235	1436.583	753.318	1439.155	753.405	1441.731	753.497	1444.310	753.592	1446.893	753.692	1449.479	753.796	1452.069	753.905	1454.662	754.017	1457.258	754.134	1800	
1700	1272.399	669.472	1274.965	669.552	1277.534	669.635	1280.107	669.724	1282.685	669.817	1285.266	669.915	1287.851	670.018	1290.440	670.125	1293.033	670.237	1295.630	670.355	1298.230	670.476	1300.834	670.603	1303.443	670.734	1700	
1600	1118.485	586.952	1121.060	586.042	1123.640	586.138	1126.223	586.239	1128.811	586.346	1131.404	586.458	1134.000	586.575	1136.602	586.698	1139.208	586.826	1141.818	586.960	1144.433	587.099	1147.052	587.244	1149.676	587.394	1600	
1500	964.595	502.461	967.182	502.567	969.775	502.678	972.372	502.796	974.975	502.920	977.582	503.051	980.195	503.188	982.813	503.331	985.437	503.481	988.065	503.637	990.698	503.799	993.337	503.968	995.980	504.143	1500	
1400	810.743	419.017	813.347	419.143	815.958	419.277	818.574	419.418	821.197	419.567	823.826	419.724	826.460	419.888	829.102	420.061	831.749	420.240	834.402	420.427	837.062	420.622	839.727	420.825	842.398	421.034	1400	
1300	656.958	335.654	659.587	335.812	662.224	335.979	664.869	336.156	667.521	336.342	670.182	336.538	672.850	336.743	675.525	336.958	678.208	337.182	680.898	337.416	683.596	337.660	686.301	337.912	689.014	338.175	1300	
1200	499.474	302.347	502.147	302.522	504.827	302.708	507.514	302.904	510.209	303.111	512.911	303.329	515.621	303.557	518.338	303.795	521.063	304.044	523.795	304.304	526.535	304.575	529.283	304.855	532.038	305.147	1200	100 (P)*
1100	340.107	294.025	342.755	294.205	345.411	294.396	348.076	294.598	350.750	294.811	353.433	295.033	356.123	295.269	358.822	295.515	361.530	295.771	364.246	296.038	366.971	296.316	369.705	296.605	372.446	296.905	1100	
1000	303.503	255.454	305.974	255.664	308.656	252.886	311.348	253.122	314.049	253.370	316.760	253.631	319.482	253.905	322.213	254.191	324.954	254.490	327.705	254.801	330.465	255.125	333.235	255.462	336.015	255.812	1000	
950	426.572	216.976	429.277	211.228	431.993	211.495	434.721	211.777	437.462	212.075	440.213	212.387	442.977	212.715	445.752	213.058	448.539	213.417	451.337	213.790	454.146	214.178	456.967	214.582	459.799	215.000	950	
900	393.911	194.424	398.633	194.698	401.367	194.988	404.115	195.295	406.875	195.618	409.647	195.958	412.432	196.314	415.229	196.687	418.040	197.076	420.862	197.481	423.697	197.903	426.543	198.341	429.402	198.795	900	80 (P)*
850	349.969	169.660	352.722	169.874	355.490	170.308	358.273	170.660	361.069	171.032	363.880	171.422	366.705	171.831	369.544	172.259	372.398	172.706	375.265	173.171	378.145	173.655	381.040	174.158	383.948	174.680	850	
800	304.114	145.007	306.909	145.377	309.721	145.769	312.550	146.183	315.395	146.619	318.257	147.077	321.135	147.558	324.029	148.060	326.939	148.584	329.865	149.131	332.806	149.699	335.763	150.289	338.735	150.900	800	
750	281.233	132.743	284.055	133.148	286.895	133.578	289.754	134.031	292.630	134.509	295.522	135.011	298.435	135.537	301.363	136.087	304.309	136.661	307.272	137.259	310.251	137.881	313.247	138.526	316.260	139.196	750	
725	255.620	108.412	258.513	108.913	241.427	109.444	244.364	110.005*	247.321	110.595	250.299	111.215	253.298	111.864	256.317	112.543	259.356	113.250	262.414	113.987	265.492	114.753	268.590	115.548	271.706	116.372	725	
700	197.857	88.476	200.837	89.099	203.844	89.760	206.875	90.457	209.932	91.190	213.012	91.960	216.116	92.765	219.244	93.606	222.395	94.485	225.568	95.396	228.762	96.343	231.979	97.326	235.216	98.342	700	
650	182.856	80.649	185.883	81.340	188.938	82.071	192.020	82.843	195.128	83.654	198.263	84.505	201.422	85.396	204.606	86.326	207.814	87.295	211.045	88.302	214.300	89.348	217.578	90.431	220.874	91.552	650	50 (P)
600	167.945	72.952	171.029	73.726	174.142	74.545	177.284	75.409	180.454	76.317	183.652	77.268	186.876	78.264	190.126	79.302	193.401	80.383	196.700	81.507	200.023	82.672	203.369	83.878	206.736	85.125	600	50 (H)**
575	153.157	65.439	156.309	66.318	159.493	67.248	162.708	68.228	165.953	69.257	169.226	70.335	172.527	71.462	175.855	72.636	179.208	73.857	182.586	75.124	185.988	76.437	189.412	77.795	192.858	79.197	575	
550	138.543	58.197	141.780	59.213	145.051	60.287	148.354	61.418	151.689	62.603	155.052	63.844	158.444	65.138	161.863	66.485	165.307	67.883	168.774	69.333	172.263	70.832	175.773	72.380	179.302	73.975	550	40 (P)*
525	131.324	54.720	134.611	55.822	137.933	56.985	141.288	58.208	144.673	59.490	148.088	60.830	151.533	62.226	154.999	63.678	158.492	65.184	162.006	66.743	165.541	68.353	169.094	70.014	172.665	71.723	525	
500	124.182	51.375	127.525	52.578	130.904	53.845	134.314	55.176	137.755	56.569	141.225	58.024	144.721	59.538	148.240	61.109	151.782	62.738	155.343	64.420	158.922	66.156	162.516	67.943	166.123	69.779	500	40 (H)**
475	117.135	48.202	120.540	49.522	123.980	50.912	127.451	52.370	130.951	53.894	134.477	55.481	138.026	57.131	141.596	58.840	145.185	60.607	148.788	62.430	152.404	64.306	156.030	66.233	159.663	68.208	475	35 (P)*
450	110.294	45.256	113.677	46.717	117.182	48.253	120.716	49.860	124.275	51.536	127.855	53.278	131.454	55.084	135.068	56.950	138.695	58.874	142.336	60.852							450	
425	103.413	42.617	106.958	44.249	110.528	45.958	114.121	47.741	117.732	49.595	121.356	51.514															425	30 (H)**
400	100.745	41.573	104.315	43.362	107.909	45.169	111.521	47.031	115.148	48.962																	400	30 (P)*
375	96.790	40.605	100.396	42.241	104.020	44.155																					375	30 (H)**
350																											350	
325																											325	28 (P)*
300																											300	25 (H)**
275																											275	25 (P)*
250																											250	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 115 Degrees

△=115°

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3931.716	2152.898	3934.220	2152.906	3936.727	2152.914	3939.233	2152.922	3941.742	2152.934	3944.252	2152.941	3946.763	2152.957	3949.276	2152.973	3951.789	2152.988	3954.304	2153.004	3956.820	2153.023	3959.338	2153.047	3961.857	2153.066	2500	
2200	3460.811	1894.534	3463.317	1894.560	3465.823	1894.568	3468.332	1894.578	3470.841	1894.590	3473.352	1894.603	3475.865	1894.618	3478.379	1894.635	3480.895	1894.653	3483.412	1894.673	3485.930	1894.695	3488.450	1894.719	3490.972	1894.744	2200	
2000	3146.875	1722.323	3149.381	1722.330	3151.888	1722.339	3154.397	1722.350	3156.908	1722.363	3159.421	1722.377	3161.934	1722.394	3164.450	1722.412	3166.967	1722.432	3169.485	1722.454	3172.006	1722.479	3174.528	1722.505	3177.052	1722.533	2000	
1800	2832.939	1550.093	2835.446	1550.101	2837.954	1550.110	2840.464	1550.122	2842.976	1550.136	2845.490	1550.152	2848.005	1550.171	2850.522	1550.191	2853.041	1550.214	2855.562	1550.238	2858.085	1550.266	2860.609	1550.295	2863.135	1550.325	1800	
1500	2362.036	1291.748	2364.544	1291.757	2367.053	1291.768	2369.565	1291.782	2372.079	1291.799	2374.595	1291.819	2377.114	1291.841	2379.635	1291.865	2382.158	1291.892	2384.683	1291.922	2387.210	1291.955	2389.739	1291.990	2392.271	1292.027	1500	
1200	1891.133	1033.403	1893.643	1033.415	1896.155	1033.429	1898.670	1033.447	1901.188	1033.468	1903.708	1033.492	1906.231	1033.520	1908.757	1033.551	1911.285	1033.584	1913.816	1033.622	1916.350	1033.662	1918.887	1033.706	1921.428	1033.752	1200	
1000	1577.198	861.175	1579.710	861.188	1582.225	861.206	1584.743	861.227	1587.264	861.252	1589.788	861.281	1592.316	861.315	1594.847	861.351	1597.381	861.392	1599.918	861.437	1602.459	861.485	1605.003	861.537	1607.550	861.594	1000	
900	1420.232	775.061	1422.745	775.076	1425.261	775.096	1427.781	775.119	1430.304	775.147	1432.832	775.179	1435.362	775.216	1437.896	775.257	1440.435	775.302	1442.976	775.352	1445.521	775.406	1448.070	775.464	1450.622	775.527	900	
800	1263.266	688.948	1265.780	688.965	1268.298	688.986	1270.821	689.013	1273.347	689.044	1275.877	689.081	1278.412	689.122	1280.951	689.168	1283.493	689.219	1286.040	689.275	1288.591	689.335	1291.146	689.401	1293.704	689.471	800	
700	1106.300	602.835	1108.816	602.855	1111.337	602.879	1113.863	602.910	1116.393	602.946	1118.928	602.987	1121.467	603.035	1124.011	603.087	1126.560	603.145	1129.114	603.209	1131.671	603.278	1134.234	603.353	1136.801	603.433	700	100 (P)*
600	949.335	516.724	951.854	516.746	954.378	516.775	956.908	516.811	959.443	516.853	961.984	516.901	964.530	516.956	967.082	517.018	969.638	517.085	972.200	517.160	974.768	517.241	977.341	517.328	979.919	517.421	600	
500	792.372	430.614	794.894	430.641	797.423	430.676	799.959	430.718	802.501	430.769	805.050	430.827	807.605	430.893	810.167	430.966	812.735	431.048	815.309	431.137	817.890	431.234	820.477	431.338	823.071	431.451	500	
400	635.410	344.507	637.939	344.541	640.475	344.584	643.020	344.637	645.573	344.701	648.134	344.773	650.702	344.855	653.279	344.948	655.864	345.049	658.457	345.161	661.057	345.282	663.666	345.413	666.282	345.553	400	
360	372.627	310.065	575.159	310.103	577.699	310.151	580.249	310.211	582.807	310.281	585.375	310.361	587.951	310.453	590.536	310.555	593.130	310.668	595.733	310.792	598.345	310.926	600.965	311.072	603.594	311.228	360	
350	556.932	301.455	559.464	301.494	562.006	301.544	564.557	301.604	567.117	301.676	569.686	301.760	572.264	301.854	574.852	301.959	577.449	302.075	580.055	302.203	582.670	302.341	585.293	302.490	587.926	302.651	350	
300	478.454	258.405	480.992	258.451	483.541	258.509	486.100	258.580	488.670	258.664	491.251	258.761	493.843	258.871	496.444	258.993	499.057	259.129	501.680	259.277	504.313	259.439	506.957	259.613	509.611	259.800	300	80 (P)*
250	399.980	215.359	402.525	215.413	405.083	215.483	407.655	215.569	410.239	215.669	412.835	215.786	415.445	215.917	418.066	216.064	420.701	216.227	423.348	216.406	426.007	216.599	428.679	216.808	431.363	217.033	250	
230	368.591	198.142	371.140	198.201	373.704	198.277	376.281	198.370	378.872	198.479	381.477	198.605	384.096	198.749	386.728	198.909	389.374	199.086	392.033	199.279	394.706	199.490	397.392	199.717	400.092	199.961	230	
200	321.510	172.319	324.067	172.386	326.639	172.474	329.228	172.580	331.833	172.706	334.453	172.852	337.089	173.016	339.741	173.200	342.408	173.404	345.091	173.626	347.789	173.868	350.502	174.129	353.230	174.410	200	
170	274.432	146.500	276.999	146.579	279.584	146.682	282.188	146.807	284.811	146.955	287.452	147.126	290.112	147.320	292.789	147.536	295.485	147.775	298.199	148.037	300.930	148.322	303.679	148.629	306.446	148.958	170	65 (P)*
155	250.895	133.592	253.468	133.679	256.052	133.792	258.676	133.929	261.310	134.092	263.965	134.280	266.639	134.492	269.333	134.729	272.047	134.991	274.781	135.278	277.534	135.590	280.305	135.927	283.096	136.288	155	
125	203.327	107.734	206.418	107.893	209.033	108.032	211.674	108.203	214.340	108.404	217.030	108.636	219.745	108.900	222.483	109.193	225.246	109.518	228.033	109.873	230.843	110.259	233.676	110.676	236.532	111.123	125	
100	164.614	86.290	167.227	86.426	169.870	86.600	172.545	86.813	175.251	87.065	177.987	87.355	180.753	87.683	183.548	88.050	186.372	88.455	189.226	88.899	192.107	89.380	195.017	89.899	197.954	90.456	100	
90	148.933	77.698	151.585	77.849	154.217	78.042	156.911	78.279	159.639	78.558	162.399	78.880	165.193	79.245	168.019	79.652	170.877	80.102	173.767	80.594	176.687	81.128	179.638	81.704	182.618	82.321	90	50 (P)*
80	133.256	69.111	135.896	69.280	138.425	69.498	141.292	69.764	144.047	70.078	146.838	70.440	149.666	70.850	152.530	71.308	155.429	71.813	158.363	72.365	161.331	72.964	164.331	73.610	167.364	74.303	80	50 (H)**
70	117.585	60.530	120.245	60.724	122.948	60.973	125.694	61.276	128.483	61.635	131.314	62.048	134.186	62.516	137.097	63.038	140.048	63.614	143.037	64.243	146.063	64.926	149.126	65.661	152.224	66.449	70	
60	101.922	51.960	104.607	52.186	107.343	52.476	110.129	52.830	112.963	53.248	115.844	53.729	118.772	54.274	121.745	54.881	124.762	55.550	127.822	56.281	130.923	57.073	134.065	57.926	137.245	58.839	60	40 (P)*
55	94.093	47.681	96.797	47.927	99.553	48.243	102.363	48.629	105.225	49.085	108.138	49.609	111.101	50.202	114.112	50.863	117.170	51.591	120.273	52.386	123.420	53.247	126.609	54.173	129.838	55.164	55	
50	86.273	43.407	88.993	43.677	91.774	44.025	94.613	44.449	97.508	44.949	100.459	45.525	103.463	46.176	106.518	46.901	109.624	47.699	112.777	48.570	115.976	49.513	119.219	50.526	122.504	51.609	50	40 (H)**
45	78.436	39.139	81.200	39.440	84.010	39.826	86.883	40.297	89.819	40.852	92.814	41.490	95.867	42.211	98.975	43.013	102.135	43.896	105.347	44.858	108.606	45.899	111.912	47.016	115.260	48.209	45	35 (P)*
40	70.646	34.882	73.419	35.220	76.265	35.654	79.182	36.182	82.166	36.805	85.215	37.521	88.326	38.328	91.497	39.226	94.723	40.213	98.003	41.287	101.333	42.447	104.709	43.690	108.129	45.016	40	35 (H) 30 (P)*
35	62.847	30.638	65.657	31.024	68.549	31.519	71.518	32.122	74.563	32.831	77.678	33.645	80.861	34.582	84.107	35.580	87.412	36.697	90.772	37.911	94.183	39.219	97.640	40.618	101.140	42.105	35	
33	59.732	28.946	62.559	29.355	65.472	29.879	68.467	30.518	71.540	31.268	74.687	32.129	77.903	33.099	81.183	34.174	84.524	35.353	87.920	36.633	91.366	38.010	94.858	39.481	98.390	41.043	33	
30	55.064	26.415	57.922	26.865	60.873	27.440	63.911	28.140	67.032	28.963	70.231	29.906	73.502	30.965	76.840	32.139	80.238	33.424	83.692	34.815	87.194	36.310	90.739	37.903	94.321	39.390	30	30 (H)**
25	47.306	22.225	50.230	22.763	53.259	23.450	56.388	24.285	59.609	25.263	62.914	26.380	66.295	27.632	69.743	29.013	73.250	30.517	76.807	32.139	80.404	33.871	84.034	35.708	87.687	37.640	25	
23	44.214	20.362	47.170	21.146	50.239	21.892	53.413	22.795	56.683	23.853	60.038	25.038	63.469	26.406	66.966	27.889	70.519	29.501	74.117	31.233	77.749	33.078	81.405	35.027			23	25 (P)*
20	39.591	18.091	42.607	18.760	45.748	19.613	49.002	20.644	52.355	21.845	55.795	23.210	59.308	24.729	62.881	26.393	66.499	28.191	70.150	30.112							20	25 (H)**
15	31.956	14.070	35.116	14.953	38.420	16.070	41.846	17.408	45.370	18.951	48.967	20.683	52.612	22.584													15	20 (P)*
14	30.445	13.290	33.643	14.232	36.989	15.421	40.456	16.842	44.016	18.475	47.642	20.300															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle 115 Degrees

$\Delta = 115°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3564.377	2153.094	3966.898	2153.117	3969.421	2153.145	3971.946	2153.172	3974.471	2153.203	3976.998	2153.234	3979.525	2153.270	3982.055	2153.303	3984.585	2153.340	3987.118	2153.379	3989.651	2153.418	3992.185	2153.457	3994.721	2153.500	2500	
2200	3493.694	1894.772	3495.019	1894.801	3498.345	1894.832	3501.672	1894.863	3503.602	1894.899	3506.132	1894.935	3508.664	1894.973	3511.197	1895.012	3513.731	1895.054	3516.268	1895.097	3518.805	1895.142	3521.344	1895.189	3523.885	1895.237	2200	
2000	3179.377	1722.563	3182.104	1722.593	3184.632	1722.629	3187.162	1722.665	3189.694	1722.702	3192.228	1722.742	3194.762	1722.784	3197.299	1722.827	3199.837	1722.873	3202.377	1722.920	3204.918	1722.970	3207.461	1723.021	3210.006	1723.074	2000	
1800	2865.663	1550.359	2868.193	1550.395	2870.725	1550.432	2873.258	1550.472	2875.793	1550.514	2878.330	1550.558	2880.869	1550.604	2883.410	1550.653	2885.952	1550.704	2888.496	1550.756	2891.042	1550.811	2893.590	1550.868	2896.140	1550.927	1800	
1600	2594.804	1392.067	2397.340	1292.110	2396.878	1292.155	2402.418	1292.203	2404.960	1292.253	2407.504	1292.306	2410.051	1292.362	2412.600	1292.420	2415.151	1292.480	2417.704	1292.544	2420.259	1292.610	2422.816	1292.678	2425.375	1292.750	1600	
1400	1923.968	1033.802	1926.513	1033.856	1929.060	1033.912	1931.610	1033.972	1934.163	1034.035	1936.718	1034.101	1939.276	1034.171	1941.837	1034.244	1944.401	1034.320	1946.967	1034.398	1949.535	1034.481	1952.107	1034.567	1954.681	1034.655	1400	
1200	1610.100	861.654	1612.654	861.718	1615.211	861.785	1617.771	861.857	1620.334	861.933	1622.900	862.012	1625.470	862.096	1628.043	862.183	1630.618	862.274	1633.198	862.369	1635.780	862.468	1638.365	862.571	1640.954	862.677	1200	
1000	1453.178	775.593	1455.738	775.664	1458.301	775.740	1460.867	775.819	1463.437	775.903	1466.011	775.991	1468.588	776.084	1471.168	776.181	1473.753	776.282	1476.341	776.387	1478.932	776.498	1481.527	776.612	1484.125	776.730	1000	
900	1296.267	689.546	1298.824	689.626	1301.405	689.711	1303.979	689.801	1306.558	689.895	1309.141	689.995	1311.728	690.099	1314.318	690.208	1316.913	690.321	1319.512	690.440	1322.114	690.563	1324.721	690.692	1327.331	690.825	900	
800	1139.372	603.519	1141.948	603.610	1144.530	603.708	1147.115	603.810	1149.705	603.918	1152.299	604.031	1154.898	604.150	1157.501	604.275	1160.109	604.405	1162.721	604.541	1165.339	604.682	1167.960	604.829	1170.586	604.981	800	
700	982.502	517.521	985.091	517.628	987.685	517.741	990.284	517.861	992.889	517.987	995.498	518.119	998.114	518.258	1000.734	518.403	1003.360	518.555	1005.990	518.713	1008.626	518.878	1011.268	519.049	1013.914	519.226	700	
600	825.670	431.571	828.276	431.699	830.889	431.835	833.508	431.978	836.133	432.129	838.764	432.288	841.402	432.454	844.046	432.629	846.696	432.811	849.352	433.000	852.015	433.198	854.684	433.404	857.358	433.616	600	
500	668.906	345.703	671.539	345.863	674.178	346.032	676.826	346.212	679.481	346.400	682.145	346.599	684.816	346.807	687.495	347.025	690.181	347.252	692.875	347.490	695.577	347.736	698.287	347.993	701.004	348.259	500	
400	606.232	311.395	608.878	311.572	611.534	311.760	614.197	311.960	616.869	312.169	619.551	312.390	622.240	312.621	624.938	312.863	627.645	313.115	630.359	313.379	633.083	313.653	635.814	313.938	638.554	314.233	400	
350	590.567	303.822	593.218	303.005	595.877	303.198	598.546	303.404	601.223	303.619	603.909	303.846	606.603	304.084	609.307	304.333	617.019	304.592	614.739	304.863	617.469	305.145	620.207	305.438	622.954	305.742	350	100 (P)*
300	512.276	260.201	514.951	260.213	517.636	260.439	520.332	260.678	523.037	260.929	525.753	261.194	528.478	261.471	531.214	261.761	533.960	262.064	536.716	262.380	539.482	262.708	542.257	263.050	545.043	263.404	300	
250	434.060	217.373	436.768	217.528	439.489	217.799	442.222	218.085	444.967	218.387	447.724	218.704	450.492	219.036	453.273	219.384	456.065	219.747	458.870	220.125	461.685	220.519	464.513	220.928	467.352	221.352	250	
230	402.805	200.222	405.531	200.499	408.270	200.793	411.022	201.104	413.788	201.432	416.565	201.777	419.356	202.138	422.160	202.515	424.977	202.910	427.805	203.321	430.647	203.748	433.500	204.192	436.367	204.653	230	80 (P)*
200	355.974	174.309	358.732	175.028	361.505	175.366	364.293	175.724	367.096	176.100	369.913	176.496	372.745	176.910	375.591	177.344	378.451	177.797	381.326	178.269	384.214	178.760	387.117	179.269	390.033	179.798	200	
170	309.230	149.111	312.031	149.685	314.850	150.083	317.686	150.502	320.538	150.944	323.407	151.409	326.293	151.896	329.195	152.405	332.114	152.936	335.048	153.490	337.999	154.066	340.965	154.664	343.948	155.284	170	
155	285.906	136.674	288.735	137.084	291.583	137.520	294.448	137.979	297.332	138.464	300.234	138.973	303.154	139.506	306.091	140.063	309.046	140.646	312.019	141.251	315.008	141.882	318.015	142.536	321.038	143.214	155	65 (P)*
135	239.411	111.601	242.312	112.109	245.215	112.647	248.181	113.215	251.147	113.813	254.136	114.441	257.145	115.100	260.175	115.788	263.225	116.505	266.296	117.252	269.387	118.029	272.497	118.834	275.626	119.669	135	
100	200.918	91.051	203.909	91.683	206.926	92.352	209.969	93.058	213.037	93.802	216.130	94.582	219.247	95.398	222.389	96.251	225.553	97.140	228.741	98.065	231.952	99.025	235.184	100.021	238.438	101.052	100	
90	185.628	82.980	188.666	83.680	191.733	84.422	194.828	85.204	197.949	86.026	201.097	86.889	204.271	87.792	207.470	88.735	210.694	89.717	213.941	90.738	217.213	91.798	220.507	92.896	223.823	94.032	90	50 (P)
80	170.430	75.041	173.326	75.826	176.652	76.656	179.808	77.532	183.093	78.452	186.206	79.417	189.446	80.426	192.713	81.478	196.006	82.574	199.324	83.713	202.666	84.894	206.031	86.117	209.419	87.381	80	50 (H)**
70	155.357	67.289	158.523	68.181	161.722	69.123	164.953	70.116	168.214	71.160	171.505	72.252	174.825	73.394	178.172	74.584	181.545	75.822	184.944	77.106	188.367	78.437	191.813	79.814	195.281	81.235	70	
60	140.462	59.411	143.716	60.842	147.005	61.931	150.326	63.076	153.680	64.278	157.064	65.536	160.477	66.847	163.917	68.213	167.384	69.630	170.874	71.099	174.388	72.619	177.923	74.188	181.479	75.805	60	40 (P)*
55	133.106	56.219	136.411	57.336	139.752	58.515	143.127	59.755	146.533	61.054	149.970	62.412	153.435	63.828	156.927	65.299	160.444	66.826	163.984	68.406	167.545	70.038	171.125	71.721	174.723	73.454	55	
50	125.829	52.760	129.192	53.979	132.590	55.263	136.023	56.613	139.486	58.025	142.980	59.500	146.500	61.034	150.045	62.627	153.613	64.278	157.202	65.983	160.809	67.743	164.431	69.554	168.068	71.415	50	40 (H)**
45	118.649	49.473	122.078	50.814	125.538	52.223	129.032	53.700	132.557	55.245	136.109	56.854	139.685	58.526	143.283	60.259	146.900	62.050	150.533	63.898	154.179	65.799	157.836	67.752	161.501	69.755	45	35 (P)*
40	111.589	46.420	115.086	47.902	118.616	49.459	122.175	51.088	125.761	52.787	129.370	54.552	132.998	56.383	136.643	58.274	140.299	60.224	143.964	62.239							40	30 (H)**
35	104.676	43.677	108.246	45.332	111.843	47.064	115.465	48.872	119.106	50.750	122.762	52.696															35	
33	101.958	42.693	105.556	44.425	109.178	46.237	112.821	48.124	116.479	50.082																	33	30 (P)*
30	97.933	41.267	101.570	43.228	105.224	45.168																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 116 Degrees

$\Delta = 116°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h		
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s				
metre																									metre			
2500	4008.334	2217.699	4010.839	2217.707	4013.345	2217.715	4015.852	2217.723	4018.361	2217.730	4020.871	2217.742	4023.382	2217.758	4025.895	2217.773	4028.409	2217.789	4030.924	2217.809	4033.440	2217.824	4035.959	2217.848	4038.478	2217.871	2500	
2200	3528.236	1951.578	3530.741	1951.586	3533.248	1951.594	3535.756	1951.602	3538.266	1951.613	3540.777	1951.629	3543.290	1951.641	3545.805	1951.660	3548.321	1951.680	3550.838	1951.699	3553.357	1951.723	3555.877	1951.746	3558.399	1951.770	2200	
2000	3208.170	1774.163	3210.676	1774.170	3213.183	1774.179	3215.693	1774.190	3218.204	1774.203	3220.716	1774.218	3223.230	1774.234	3225.746	1774.253	3228.263	1774.273	3230.782	1774.296	3233.303	1774.321	3235.826	1774.347	3238.350	1774.376	2000	
1800	2888.104	1596.749	2890.611	1596.757	2893.119	1596.766	2895.630	1596.778	2898.142	1596.793	2900.656	1596.809	2903.171	1596.828	2905.689	1596.848	2908.208	1596.871	2910.729	1596.896	2913.253	1596.924	2915.778	1596.953	2918.304	1596.985	1800	
1560	2408.007	1330.628	2410.515	1330.637	2413.025	1330.649	2415.537	1330.663	2418.051	1330.680	2420.568	1330.700	2423.087	1330.722	2425.608	1330.747	2428.131	1330.774	2430.657	1330.805	2433.184	1330.838	2435.714	1330.873	2438.246	1330.911	1560	
1200	1927.910	1064.508	1930.420	1064.519	1932.932	1064.534	1935.448	1064.552	1937.966	1064.573	1940.486	1064.598	1943.010	1064.625	1945.536	1064.657	1948.065	1064.691	1950.597	1064.729	1953.132	1064.770	1955.669	1064.814	1958.209	1064.861	1200	
1000	1607.846	887.095	1610.358	887.109	1612.873	887.127	1615.391	887.148	1617.913	887.174	1620.438	887.203	1622.966	887.237	1625.498	887.274	1628.032	887.315	1630.570	887.360	1633.112	887.409	1635.656	887.462	1638.205	887.520	1000	
900	1447.815	798.389	1450.328	798.405	1452.843	798.424	1455.365	798.448	1457.889	798.477	1460.416	798.509	1462.948	798.547	1465.483	798.588	1468.022	798.634	1470.564	798.684	1473.110	798.739	1475.659	798.798	1478.213	798.861	900	
800	1287.784	709.684	1290.298	709.701	1292.817	709.723	1295.340	709.750	1297.867	709.782	1300.398	709.819	1302.933	709.861	1305.473	709.907	1308.016	709.959	1310.564	710.016	1313.115	710.077	1315.671	710.143	1318.231	710.215	800	
700	1127.753	620.979	1130.270	620.999	1132.791	621.024	1135.317	621.055	1137.848	621.092	1140.384	621.134	1142.924	621.182	1145.469	621.235	1148.018	621.294	1150.573	621.359	1153.132	621.429	1155.696	621.505	1158.264	621.586	700	100 (P)*
600	967.724	532.276	970.243	532.299	972.768	532.328	975.299	532.364	977.834	532.407	980.376	532.456	982.923	532.512	985.475	532.574	988.033	532.643	990.596	532.718	993.165	532.800	995.740	532.889	998.319	532.984	600	
500	807.696	443.574	810.219	443.602	812.749	443.637	815.285	443.680	817.828	443.731	820.378	443.790	822.934	443.857	825.497	443.932	828.066	444.014	830.642	444.105	833.224	444.203	835.813	444.309	838.409	444.423	500	
400	647.670	354.875	650.199	354.910	652.736	354.954	655.282	355.008	657.836	355.072	660.398	355.146	662.968	355.229	665.546	355.323	668.132	355.425	670.727	355.539	673.330	355.661	675.940	355.794	678.559	355.936	400	
360	583.661	319.397	586.193	319.435	588.734	319.484	591.285	319.545	593.845	319.615	596.414	319.697	598.991	319.790	601.578	319.894	604.174	320.009	606.779	320.134	609.393	320.270	612.016	320.418	614.647	320.576	360	
350	567.659	310.528	570.192	310.567	572.735	310.618	575.287	310.679	577.848	310.752	580.418	310.836	582.998	310.932	585.588	311.039	588.187	311.157	590.794	311.286	593.412	311.426	596.037	311.577	598.673	311.740	350	
300	487.649	266.182	490.186	266.228	492.738	266.287	495.298	266.359	497.870	266.444	500.452	266.542	503.045	266.654	505.649	266.778	508.264	266.916	510.889	267.066	513.526	267.230	516.172	267.407	518.829	267.596	300	80 (P)*
250	407.643	221.840	410.189	221.895	412.749	221.966	415.321	222.052	417.906	222.155	420.505	222.272	423.117	222.406	425.741	222.555	428.378	222.720	431.028	222.901	433.691	223.097	436.366	223.309	439.054	223.537	250	
230	375.641	204.103	378.191	204.163	380.756	204.241	383.335	204.335	385.928	204.447	388.535	204.575	391.156	204.720	393.791	204.882	396.439	205.061	399.102	205.258	401.779	205.471	404.469	205.701	407.172	205.949	230	
220	327.641	177.504	330.199	177.573	332.773	177.661	335.363	177.769	337.970	177.897	340.593	178.044	343.232	178.211	345.886	178.398	348.557	178.604	351.243	178.830	353.945	179.075	356.663	179.340	359.395	179.624	220	
170	279.644	150.907	282.212	150.982	284.799	151.092	287.405	151.219	290.031	151.369	292.674	151.543	295.337	151.739	298.018	151.958	300.718	152.201	303.436	152.466	306.172	152.755	308.926	153.066	311.698	153.400	170	65 (P)*
155	255.648	137.811	258.222	137.700	260.817	137.814	263.434	137.953	266.071	138.118	268.728	138.308	271.406	138.523	274.104	138.764	276.823	139.030	279.561	139.321	282.319	139.637	285.096	139.978	287.893	140.344	155	
125	207.661	111.026	210.253	111.136	212.871	111.278	215.514	111.451	218.183	111.655	220.877	111.890	223.596	112.157	226.340	112.455	229.108	112.784	231.900	113.145	234.717	113.536	237.557	113.958	240.420	114.412	125	
100	167.682	88.883	170.296	89.022	172.943	89.199	175.622	89.415	178.331	89.670	181.072	89.964	183.843	90.297	186.644	90.669	189.476	91.080	192.336	91.529	195.226	92.017	198.144	92.544	201.090	93.108	100	
90	151.695	80.033	154.322	80.186	156.985	80.383	159.682	80.622	162.414	80.906	165.180	81.232	167.980	81.602	170.813	82.015	173.678	82.471	176.576	82.970	179.505	83.511	182.465	84.095	185.456	84.721	90	50 (P)*
80	135.712	71.187	138.355	71.359	141.027	71.580	143.758	71.850	146.518	72.168	149.316	72.535	152.150	72.951	155.022	73.415	157.929	73.927	160.872	74.487	163.849	75.094	166.861	75.749	169.905	76.452	80	50 (H)**
70	119.735	62.345	122.397	62.544	125.105	62.797	127.856	63.105	130.651	63.468	133.489	63.887	136.368	64.362	139.288	64.891	142.248	65.475	145.247	66.113	148.285	66.805	151.360	67.551	154.471	68.349	70	
60	103.766	53.519	106.455	53.748	109.195	54.042	111.987	54.401	114.828	54.825	117.717	55.313	120.654	55.865	123.637	56.481	126.665	57.159	129.737	57.900	132.851	58.704	136.006	59.568	139.202	60.494	60	40 (P)*
55	95.786	49.111	98.492	49.360	101.253	49.681	104.069	50.072	106.939	50.534	109.861	51.066	112.834	51.667	115.856	52.337	118.925	53.075	122.042	53.881	125.202	54.755	128.406	55.694	131.652	56.699	55	
50	87.811	44.707	90.536	44.982	93.322	45.335	96.168	45.765	99.072	46.272	102.032	46.856	105.047	47.515	108.114	48.250	111.232	49.060	114.400	49.943	117.614	50.899	120.874	51.926	124.177	53.024	50	40 (H)**
45	79.841	40.311	82.590	40.616	85.406	41.008	88.288	41.485	91.232	42.047	94.238	42.695	97.303	43.425	100.424	44.239	103.599	45.134	106.826	46.110	110.103	47.165	113.427	48.298	116.795	49.507	45	35 (P)*
40	71.879	35.925	74.658	36.268	77.511	36.707	80.436	37.243	83.430	37.875	86.491	38.600	89.616	39.419	92.801	40.329	96.044	41.330	99.342	42.419	102.690	43.595	106.087	44.856	109.529	46.200	40	35 (H) 30 (P)*
35	63.928	31.552	66.744	31.944	69.644	32.445	72.624	33.056	75.680	33.775	78.809	34.601	82.007	35.530	85.269	36.563	88.593	37.696	91.973	38.926	95.405	40.252	98.886	41.671	102.409	43.179	35	
33	60.752	29.809	63.586	30.224	66.508	30.755	69.513	31.402	72.599	32.163	75.759	33.036	78.991	34.019	82.289	35.110	85.650	36.305	89.066	37.602	92.535	38.999	96.051	40.491	99.609	42.075	33	
30	55.993	27.201	58.859	27.657	61.819	28.240	64.868	28.950	68.003	29.784	71.218	30.740	74.506	31.814	77.863	33.005	81.283	34.307	84.759	35.718	88.286	37.233	91.857	38.848	95.467	40.559	30	30 (H)**
25	48.084	22.882	51.016	23.428	54.057	24.125	57.200	24.971	60.437	25.963	63.760	27.096	67.162	28.365	70.633	29.765	74.164	31.290	77.747	32.935	81.374	34.691	85.034	36.553	88.718	38.513	25	
23	44.931	21.169	47.897	21.761	50.979	22.517	54.167	23.433	57.454	24.505	60.829	25.727	64.283	27.094	67.804	28.598	71.383	30.232	75.010	31.988	78.672	33.859	82.360	35.835			23	25 (P)*
20	40.218	18.622	43.246	19.300	46.401	20.165	49.671	21.210	53.044	22.428	56.506	23.812	60.044	25.352	63.645	27.059	67.293	28.862	70.975	30.810							20	25 (H)**
15	32.434	14.475	35.609	15.370	38.932	16.502	42.380	17.859	45.929	19.424	49.554	21.180	53.221	23.107													15	20 (P)*
14	30.894	13.670	34.108	14.625	37.473	15.831	40.964	17.271	44.551	18.928	48.207	20.778															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Deviation Angle = 116 Degrees

TABLE 16 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

△=116°

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	3072.868	1430.498	3075.385	1430.520	3077.902	1430.542	3080.421	1430.567	3082.941	1430.593	3085.461	1430.619	3087.983	1430.647	3090.506	1430.677	3093.029	1430.708	3095.544	1430.740	3098.080	1430.773	3100.606	1430.808	3103.134	1430.844	2500	
2200	2708.957	1258.881	2711.476	1258.906	2713.996	1258.932	2716.517	1258.959	2719.040	1258.989	2721.563	1259.019	2724.087	1259.051	2726.613	1259.084	2729.140	1259.119	2731.668	1259.156	2734.197	1259.194	2736.727	1259.233	2739.258	1259.274	2200	
2000	2466.353	1144.474	2468.873	1144.501	2471.395	1144.530	2473.918	1144.560	2476.443	1144.592	2478.969	1144.625	2481.496	1144.661	2484.024	1144.697	2486.554	1144.736	2489.084	1144.776	2491.616	1144.818	2494.149	1144.861	2496.684	1144.906	2000	
1800	2225.751	1030.071	2226.274	1030.101	2228.799	1030.133	2231.325	1030.166	2233.852	1030.202	2236.380	1030.239	2238.910	1030.278	2241.442	1030.319	2243.974	1030.362	2246.508	1030.406	2249.044	1030.453	2251.581	1030.501	2254.119	1030.551	1800	
1500	1839.858	858.478	1862.386	858.514	1864.915	858.552	1867.446	858.592	1869.979	858.635	1872.513	858.679	1875.049	858.727	1877.586	858.776	1880.125	858.827	1882.667	858.881	1885.209	858.936	1887.753	858.994	1890.299	859.054	1500	
1200	1495.983	686.908	1498.518	686.953	1501.054	687.001	1503.592	687.051	1506.133	687.104	1508.676	687.160	1511.221	687.219	1513.768	687.281	1516.316	687.344	1518.867	687.411	1521.420	687.481	1523.975	687.553	1526.532	687.628	1200	
1000	1253.417	572.551	1255.958	572.605	1258.502	572.663	1261.048	572.723	1263.597	572.787	1266.148	572.854	1268.702	572.925	1271.258	572.998	1273.816	573.075	1276.377	573.155	1278.941	573.239	1281.507	573.326	1284.074	573.416	1000	
900	1132.143	515.385	1134.689	515.445	1137.237	515.509	1139.788	515.576	1142.343	515.647	1144.899	515.721	1147.459	515.799	1150.021	515.881	1152.586	515.967	1155.153	516.056	1157.724	516.149	1160.297	516.245	1162.873	516.345	900	
800	1010.877	458.229	1013.429	458.297	1015.984	458.369	1018.541	458.445	1021.102	458.524	1023.666	458.608	1026.232	458.696	1028.802	458.788	1031.375	458.885	1033.951	458.985	1036.530	459.089	1039.112	459.198	1041.697	459.310	800	
700	889.625	401.091	892.183	401.168	894.746	401.250	897.311	401.337	899.880	401.428	902.453	401.524	905.029	401.624	907.609	401.730	910.192	401.840	912.778	401.954	915.368	402.073	917.961	402.198	920.558	402.326	700	
600	768.391	343.978	770.959	344.068	773.531	344.164	776.108	344.265	778.688	344.371	781.272	344.483	783.861	344.600	786.454	344.723	789.050	344.851	791.651	344.985	794.255	345.124	796.864	345.268	799.476	345.418	600	
500	647.186	286.904	649.768	287.012	652.354	287.127	654.956	287.248	657.542	287.376	660.143	287.510	662.748	287.650	665.359	287.798	667.974	287.952	670.594	288.112	673.219	288.279	675.848	288.452	678.482	288.632	500	
400	526.033	229.901	528.635	230.035	531.242	230.178	533.856	230.330	536.475	230.490	539.101	230.657	541.731	230.833	544.369	231.017	547.011	231.209	549.660	231.409	552.315	231.618	554.975	231.834	557.641	232.059	400	
360	477.596	207.132	480.208	207.281	482.828	207.441	485.453	207.609	488.085	207.786	490.724	207.972	493.369	208.168	496.021	208.372	498.679	208.585	501.343	208.807	504.014	209.039	506.691	209.280	509.375	209.529	360	100 (P)*
350	465.490	201.443	468.105	201.598	470.728	201.761	473.357	201.934	475.993	202.117	478.635	202.308	481.284	202.509	483.940	202.719	486.602	202.938	489.271	203.167	491.947	203.406	494.628	203.653	497.317	203.909	350	
300	404.983	173.036	407.617	173.216	410.259	173.407	412.908	173.609	415.566	173.821	418.231	174.044	420.903	174.278	423.584	174.524	426.271	174.779	428.967	175.046	431.670	175.323	434.380	175.612	437.098	175.911	300	
250	344.532	144.708	347.192	144.924	349.861	145.153	352.539	145.395	355.226	145.649	357.922	145.917	360.627	146.198	363.341	146.492	366.064	146.798	368.796	147.118	371.536	147.450	374.286	147.796	377.043	148.154	250	
230	320.377	133.411	323.050	133.646	325.732	133.894	328.425	134.157	331.127	134.434	333.839	134.725	336.561	135.030	339.292	135.349	342.033	135.682	344.783	136.029	347.543	136.390	350.312	136.765	353.090	137.154	230	80 (P)*
200	284.181	116.520	286.878	116.789	289.587	117.075	292.306	117.376	295.037	117.694	297.778	118.029	300.531	118.379	303.293	118.745	306.067	119.128	308.851	119.526	311.646	119.941	314.451	120.371	317.266	120.818	200	
170	248.052	99.724	250.781	100.040	253.524	100.376	256.279	100.730	259.047	101.104	261.827	101.496	264.619	101.907	267.424	102.338	270.240	102.787	273.069	103.254	275.909	103.740	278.761	104.246	281.625	104.769	170	
155	230.023	91.379	232.773	91.726	235.537	92.093	238.315	92.482.	241.106	92.891	243.910	93.321	246.728	93.771	249.559	94.242	252.402	94.734	255.258	95.246	258.127	95.778	261.009	96.331	263.902	96.904	155	65 (P)*
125	194.079	74.858	196.883	75.287	199.703	75.742	202.540	76.222	205.392	76.727	208.260	77.258	211.143	77.814	214.041	78.395	216.954	79.001	219.882	74.632	222.824	80.288	225.779	80.968	228.749	81.674	125	
100	164.314	61.382	167.183	61.916	170.072	62.481	172.980	63.078	175.905	63.706	178.849	64.365	181.810	65.054	184.788	65.775	187.782	66.526	190.793	67.307	193.819	68.118	196.861	68.959	199.917	69.830	100	
90	152.486	56.117	155.390	56.709	158.315	57.335	161.259	57.996	164.223	58.691	167.206	59.420	170.207	60.182	173.225	60.978	176.261	61.808	179.313	62.670	182.381	63.566	185.465	64.493	188.563	65.453	90	50 (P)
80	140.724	50.964	143.670	51.627	146.637	52.329	149.626	53.068	152.634	53.845	155.663	54.660	158.710	55.513	161.775	56.402	164.858	57.327	167.957	58.289	171.073	59.287	174.204	60.320	177.349	61.388	80	50 (H)**
70	129.053	45.969	132.049	46.722	135.067	47.518	138.108	48.357	141.169	49.239	144.250	50.162	147.351	51.126	150.470	52.131	153.606	53.177	156.759	54.262	159.927	55.386	163.109	56.549	166.305	57.749	70	
60	117.307	41.205	120.563	42.076	123.643	42.996	126.745	43.963	129.869	44.979	133.012	46.041	136.174	47.149	139.352	48.302	142.547	49.500	145.757	50.741	148.979	52.024	152.214	53.350	155.459	54.716	60	40 (P)*
55	111.797	38.947	114.888	39.891	118.003	40.887	121.140	41.934	124.298	43.032	127.474	44.179	130.668	45.375	133.878	46.618	137.103	47.907	140.340	49.242	143.588	50.620	146.846	52.042	150.112	53.506	55	
50	106.140	36.802	109.270	37.832	112.422	38.917	115.596	40.056	118.789	41.250	122.000	42.495	125.226	43.791	128.466	45.137	131.718	46.531	134.980	47.972	138.250	49.458	141.525	50.988	144.806	52.560	50	40 (H)**
45	100.548	34.804	103.718	35.934	106.910	37.125	110.122	38.373	113.351	39.677	116.594	41.037	119.850	42.449	123.116	43.913	126.390	45.426	129.669	46.986	132.951	48.593	136.234	50.243	139.515	51.934	45	35 (P)*
40	95.031	33.000	98.244	34.251	101.476	35.566	104.723	36.942	107.984	38.377	111.254	39.869	114.532	41.415	117.814	43.013	121.097	44.660	124.378	46.354							40	30 (H)**
35	89.602	31.459	92.854	32.857	96.120	34.320	99.396	35.847	102.677	37.434	105.960	39.078															35	
33	87.455	30.938	90.721	32.402	93.997	33.932	97.278	35.526	100.561	37.180																	33	30 (P)*
30	84.260	30.284	87.540	31.856	90.822	33.495																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrian **H = Mountainous & Steep Terrain

Appendix 3

TABLE 19: TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 117 Degrees

$\Delta = 117°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	4087.129	2284.707	4089.634	2284.711	4092.140	2284.719	4094.647	2284.727	4097.156	2284.738	4099.668	2284.750	4102.180	2284.762	4104.691	2284.777	4107.207	2284.797	4109.723	2284.812	4112.238	2284.832	4114.758	2284.855	4117.277	2284.879	2500	
2200	3597.575	2010.543	3600.081	2010.551	3602.588	2010.559	3605.096	2010.566	3607.606	2010.578	3610.118	2010.594	3612.631	2010.609	3615.146	2010.625	3617.662	2010.645	3620.179	2010.664	3622.699	2010.687	3625.219	2010.711	3627.742	2010.738	2200	
2000	3271.206	1827.768	3273.712	1827.775	3276.220	1827.783	3278.729	1827.795	3281.240	1827.808	3283.753	1827.823	3286.268	1827.840	3288.783	1827.858	3291.301	1827.879	3293.821	1827.902	3296.342	1827.927	3298.865	1827.954	3301.389	1827.983	2000	
1800	2944.837	1644.993	2947.344	1645.001	2949.852	1645.010	2952.363	1645.022	2954.875	1645.037	2957.389	1645.054	2959.905	1645.073	2962.423	1645.094	2964.943	1645.117	2967.464	1645.142	2969.988	1645.170	2972.513	1645.200	2975.041	1645.232	1800	
1500	2455.284	1370.831	2457.792	1370.841	2460.302	1370.852	2462.814	1370.867	2465.329	1370.884	2467.846	1370.904	2470.365	1370.927	2472.887	1370.952	2475.411	1370.980	2477.937	1371.011	2480.465	1371.044	2482.996	1371.080	2485.528	1371.118	1500	
1200	1965.732	1096.670	1968.242	1096.682	1970.755	1096.697	1973.270	1096.715	1975.789	1096.737	1978.310	1096.762	1980.834	1096.790	1983.361	1096.822	1985.890	1096.856	1988.422	1096.893	1990.958	1096.936	1993.496	1096.981	1996.037	1097.029	1200	
1000	1639.365	913.897	1641.876	913.911	1644.392	913.929	1646.911	913.951	1649.432	913.977	1651.958	914.007	1654.487	914.041	1657.019	914.079	1659.554	914.121	1662.093	914.166	1664.635	914.216	1667.181	914.270	1669.730	914.328	1000	
900	1476.181	822.511	1478.695	822.527	1481.212	822.547	1483.732	822.571	1486.257	822.600	1488.785	822.633	1491.317	822.671	1493.853	822.713	1496.392	822.760	1498.935	822.811	1501.482	822.866	1504.033	822.926	1506.587	822.990	900	
800	1312.999	731.126	1315.513	731.143	1318.032	731.166	1320.556	731.193	1323.083	731.226	1325.615	731.263	1328.151	731.305	1330.691	731.353	1333.235	731.405	1335.784	731.462	1338.337	731.524	1340.894	731.592	1343.455	731.664	800	100 (P)*
700	1149.816	639.741	1152.333	639.761	1154.855	639.787	1157.382	639.818	1159.913	639.855	1162.449	639.898	1164.990	639.946	1167.536	640.000	1170.087	640.060	1172.643	640.126	1175.202	640.197	1177.768	640.274	1180.337	640.356	700	
600	986.635	548.357	989.155	548.381	991.680	548.411	994.211	548.447	996.748	548.490	999.290	548.540	1001.838	548.597	1004.391	548.660	1006.950	548.729	1009.515	548.806	1012.085	548.889	1014.661	548.979	1017.242	549.075	600	
500	823.455	456.976	825.979	457.004	828.509	457.039	831.046	457.083	833.590	457.135	836.141	457.195	838.698	457.262	841.262	457.338	843.833	457.422	846.411	457.514	848.994	457.614	851.585	457.721	854.182	457.837	500	
480	660.278	365.597	662.808	365.632	665.346	365.677	667.892	365.731	670.447	365.796	673.010	365.871	675.582	365.956	678.162	366.050	680.749	366.155	683.346	366.270	685.950	366.394	688.563	366.528	691.185	366.673	480	
360	595.008	329.047	597.541	329.085	600.083	329.135	602.635	329.196	605.196	329.268	607.766	329.351	610.345	329.445	612.934	329.550	615.532	329.667	618.139	329.794	620.755	329.932	623.380	330.082	626.014	330.242	360	
300	578.691	319.909	581.225	319.949	583.768	320.000	586.321	320.063	588.884	320.137	591.456	320.222	594.037	320.319	596.629	320.427	599.229	320.547	601.839	320.678	604.459	320.820	607.087	320.974	609.725	321.139	300	
300	497.105	274.224	499.645	274.270	502.196	274.330	504.758	274.403	507.331	274.490	509.914	274.589	512.510	274.702	515.115	274.828	517.732	274.968	520.360	275.120	523.000	275.287	525.649	275.466	528.309	275.658	300	80 (P)*
250	415.523	228.542	418.071	228.597	420.631	228.669	423.205	228.757	425.792	228.861	428.393	228.980	431.007	229.115	433.634	229.267	436.274	229.434	438.927	229.618	441.592	229.817	444.271	230.032	446.963	230.263	250	
230	382.865	210.270	385.443	210.331	388.009	210.409	390.589	210.504	393.184	210.617	395.793	210.747	398.417	210.894	401.054	211.059	403.706	211.240	406.372	211.440	409.052	211.656	411.746	211.890	414.453	212.141	230	
200	333.946	182.865	336.505	182.935	339.081	183.025	341.673	183.135	344.282	183.264	346.907	183.414	349.549	183.583	352.206	183.772	354.880	183.981	357.570	184.210	360.276	184.459	362.998	184.728	365.736	185.016	200	
170	283.004	155.465	287.573	155.547	290.162	155.653	292.770	155.781	295.398	155.934	298.045	156.110	300.711	156.309	303.396	156.531	306.099	156.777	308.822	157.046	311.563	157.339	314.322	157.655	317.099	157.994	170	65 (P)*
155	260.535	141.767	263.111	141.857	265.708	141.973	268.327	142.114	270.966	142.281	273.627	142.474	276.309	142.692	279.011	142.936	281.733	143.206	284.476	143.501	287.240	143.822	290.023	144.168	292.826	144.539	155	
125	211.603	114.378	214.197	114.490	216.817	114.633	219.463	114.809	222.136	115.016	224.834	115.255	227.557	115.525	230.306	115.828	233.079	116.161	235.878	116.527	238.701	116.924	241.548	117.352	244.419	117.812	125	
100	170.136	91.567	172.453	91.707	176.103	91.886	178.785	92.105	181.499	92.364	184.245	92.662	187.021	93.000	189.829	93.377	192.667	93.794	195.535	94.250	198.433	94.744	201.360	95.278	204.315	95.851	100	
90	154.535	82.448	157.164	82.603	159.830	82.803	162.532	83.046	165.269	83.333	168.040	83.664	170.846	84.039	173.686	84.458	176.559	84.921	179.465	85.426	182.403	85.975	185.373	86.567	188.374	87.202	90	50 (P)*
80	138.237	73.335	140.883	73.569	143.569	73.733	146.294	74.006	149.059	74.329	151.863	74.702	154.705	75.123	157.584	75.594	160.500	76.113	163.452	76.681	166.440	77.297	169.462	77.961	172.518	78.674	80	50 (H)**
70	121.945	64.228	124.611	64.427	127.323	64.683	130.079	64.995	132.880	65.364	135.725	65.789	138.612	66.270	141.541	66.807	144.511	67.399	147.521	68.046	150.570	68.748	153.657	69.504	156.782	70.314	70	
60	105.662	55.132	108.355	55.364	111.100	55.662	113.897	56.026	116.745	56.456	119.643	56.951	122.589	57.511	125.583	58.135	128.622	58.823	131.706	59.575	134.834	60.390	138.004	61.267	141.214	62.205	60	40 (P)*
55	97.525	50.589	100.235	50.843	103.001	51.168	105.824	51.565	108.702	52.033	111.633	52.572	114.615	53.182	117.648	53.861	120.731	54.610	123.860	55.428	127.036	56.313	130.255	57.266	133.518	58.285	55	
50	89.393	46.053	92.122	46.331	94.914	46.689	97.768	47.125	100.680	47.639	103.650	48.231	106.675	48.900	109.755	49.646	112.887	50.467	116.069	51.362	119.300	52.332	122.577	53.374	125.898	54.487	50	40 (H)**
45	81.266	41.523	84.020	41.832	86.843	42.229	89.732	42.713	92.686	43.284	95.703	43.940	98.780	44.681	101.914	45.506	105.105	46.414	108.348	47.404	111.643	48.474	114.985	49.623	118.373	50.849	45	35 (P)**
40	73.147	37.003	73.932	37.351	78.792	37.797	81.726	38.340	84.731	38.981	87.804	39.717	90.942	40.547	94.143	41.470	97.402	42.485	100.718	43.590	104.087	44.782	107.505	46.061	110.969	47.424	40	35 (H) 30 (P)*
35	65.040	32.498	67.862	32.895	70.770	33.403	73.760	34.023	76.829	34.752	79.971	35.589	83.185	36.532	86.465	37.579	89.807	38.728	93.208	39.976	96.662	41.321	100.166	42.760	103.715	44.289	35	
33	61.801	30.701	64.642	31.121	67.573	31.661	70.589	32.317	73.687	33.089	76.862	33.974	80.111	34.971	83.427	36.077	86.807	37.289	90.246	38.605	93.738	40.021	97.279	41.534	100.863	43.141	33	
30	56.049	28.013	59.822	28.475	62.791	29.067	65.853	29.787	69.002	30.633	72.232	31.603	75.539	32.692	78.915	33.899	82.357	35.220	85.857	36.651	89.409	38.188	93.007	39.826	96.645	41.561	30	30 (H)**
25	48.584	23.562	51.823	24.116	54.878	24.823	58.035	25.681	61.288	26.687	64.631	27.836	68.053	29.123	71.547	30.543	75.104	32.090	78.715	33.757	82.371	35.539	86.062	37.427	89.779	39.415	25	
23	45.669	21.796	48.644	22.397	51.739	23.163	54.943	24.093	58.248	25.180	61.643	26.419	65.119	27.805	68.666	29.330	72.273	30.988	75.928	32.769	79.622	34.667	83.343	36.670			23	25 (P)*
20	40.863	19.170	43.902	19.858	47.071	20.735	50.359	21.795	53.752	23.031	57.238	24.434	60.802	25.996	64.430	27.708	68.109	29.556	71.823	31.532							20	25 (H)**
15	32.927	14.894	36.116	15.801	39.458	16.950	42.928	18.326	46.504	19.913	50.159	21.694	53.868	23.649													15	20 (P)*
14	31.356	14.063	34.586	15.032	37.971	16.255	41.486	17.716	45.101	19.395	48.788	21.272															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 117 Degrees

$\Delta = 117°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	4119.797	2284.902	4122.320	2284.930	4124.844	2284.957	4127.367	2284.984	4129.895	2285.020	4132.422	2285.051	4134.953	2285.086	4137.480	2285.121	4140.016	2285.156	4142.547	2285.195	4145.082	2285.238	4147.617	2285.281	4150.156	2285.324	2500	
2200	3630.266	2010.766	3632.791	2010.797	3635.318	2010.828	3637.847	2010.863	3640.377	2010.898	3642.906	2010.934	3645.441	2010.973	3647.976	2011.016	3650.512	2011.055	3653.050	2011.102	3655.589	2011.148	3658.130	2011.195	3660.672	2011.246	2200	
2000	3300.810	1828.014	3303.444	1828.047	3308.972	1828.082	3311.504	1828.119	3314.037	1828.157	3316.572	1828.198	3319.109	1828.241	3321.646	1828.286	3324.187	1828.333	3326.728	1828.382	3329.271	1828.433	3331.816	1828.485	3334.362	1828.540	2000	
1800	2977.570	1645.267	2980.101	1645.303	2982.634	1645.342	2985.169	1645.383	2987.705	1645.426	2990.244	1645.471	2992.784	1645.519	2995.326	1645.569	2997.870	1645.621	3000.416	1645.673	3002.964	1645.731	3005.514	1645.790	3008.065	1645.851	1800	
1600	2648.063	1371.139	2650.600	1371.203	2495.140	1371.250	2495.682	1371.299	2498.225	1371.351	2500.771	1371.405	2503.320	1371.462	2505.871	1371.522	2508.423	1371.584	2510.979	1371.650	2513.536	1371.718	2516.095	1371.788	2518.657	1371.861	1600	
1400	1998.590	1097.081	2000.127	1097.133	2003.676	1097.194	2006.228	1097.255	2008.783	1097.320	2011.340	1097.388	2013.901	1097.459	2016.464	1097.534	2019.030	1097.612	2021.599	1097.694	2024.170	1097.778	2026.745	1097.866	2029.322	1097.958	1400	
1200	1672.282	914.390	1674.838	914.456	1677.397	914.525	1679.959	914.599	1682.525	914.677	1685.094	914.758	1687.666	914.844	1690.242	914.934	1692.821	915.027	1695.403	915.125	1697.989	915.227	1700.578	915.333	1703.170	915.442	1200	
1000	1309.145	823.056	1311.707	823.132	1514.273	823.209	1516.842	823.291	1519.415	823.377	1521.991	823.468	1524.572	823.563	1527.155	823.663	1529.743	823.767	1532.334	823.875	1534.930	823.989	1537.528	824.106	1540.131	824.228	1000	
900	1346.029	731.741	1348.589	731.823	1351.163	731.911	1353.741	732.003	1356.323	732.100	1358.909	732.202	1361.499	732.310	1364.093	732.422	1366.692	732.539	1369.295	732.661	1371.901	732.788	1374.512	732.920	1377.127	733.057	900	
800	1182.912	640.445	1185.491	640.538	1188.075	640.638	1190.664	640.744	1193.257	640.855	1195.855	640.971	1198.458	641.094	1201.066	641.222	1203.678	641.356	1206.295	641.495	1208.917	641.640	1211.543	641.791	1214.174	641.948	800	
700	1019.829	549.178	1022.421	549.288	1025.019	549.404	1027.622	549.527	1030.231	549.656	1032.845	549.792	1035.465	549.936	1038.090	550.085	1040.721	550.241	1043.357	550.404	1045.999	550.573	1048.646	550.749	1051.298	550.931	700	
600	856.786	457.960	859.396	458.092	862.014	458.231	864.637	458.379	867.267	458.534	869.904	458.698	872.547	458.868	875.197	459.048	877.853	459.235	880.516	459.430	883.185	459.634	885.861	459.845	888.542	460.063	600	
500	693.414	366.627	695.951	366.991	698.097	367.165	701.751	367.350	704.412	367.544	707.083	367.748	709.760	367.962	712.447	368.187	715.141	368.420	717.843	368.664	720.553	368.918	723.271	369.181	725.997	369.455	500	
450	627.652	330.414	631.310	330.596	633.971	330.790	636.642	330.995	639.321	331.210	642.010	331.437	644.707	331.675	647.413	331.924	650.127	332.185	652.851	332.456	655.583	332.736	658.324	333.029	661.074	333.332	450	100 (P)*
400	612.373	321.315	615.029	321.503	617.695	321.702	620.370	321.913	623.055	322.135	625.748	322.368	628.451	322.612	631.162	322.868	633.883	323.135	636.613	323.414	639.352	323.704	642.100	324.005	644.856	324.317	400	
350	550.981	275.964	553.663	276.083	536.355	276.315	539.059	276.561	541.773	276.819	544.497	277.091	547.232	277.376	549.978	277.675	552.734	277.986	555.500	278.311	558.277	278.648	561.064	279.000	563.862	279.364	350	
300	449.467	230.310	452.384	230.772	455.114	231.051	457.857	231.345	460.612	231.655	463.379	231.981	466.159	232.323	468.951	232.680	471.756	233.054	474.573	233.443	477.401	233.848	480.243	234.268	483.095	234.704	300	
250	417.172	212.409	419.910	212.694	422.659	212.997	425.422	213.317	428.198	213.654	430.988	214.008	433.790	214.379	436.607	214.767	439.436	215.173	442.279	215.595	445.135	216.033	448.003	216.492	450.885	216.966	250	80 (P)*
200	369.489	185.524	371.258	185.632	374.043	186.000	376.843	186.367	379.658	186.754	382.489	187.161	385.334	187.587	388.195	188.033	391.070	188.499	393.960	188.984	396.865	189.489	399.785	190.013	402.719	190.557	200	
175	319.895	159.858	322.709	159.941	325.541	159.980	328.391	159.581	331.258	160.036	334.143	160.514	337.044	161.014	339.964	161.538	342.900	162.084	345.853	162.654	348.823	163.246	351.810	163.861	354.813	164.498	175	
150	269.140	144.936	271.891	145.258	301.353	145.806	304.224	146.279	307.134	146.777	310.053	147.300	312.991	147.849	315.947	148.422	318.921	149.020	321.914	149.644	324.925	150.292	327.953	150.965	330.999	151.662	150	65 (P)*
125	267.314	118.300	250.232	118.825	253.173	119.279	256.137	119.963	259.124	120.578	262.133	121.224	265.165	121.901	268.218	122.608	271.292	123.346	274.388	124.115	277.504	124.913	280.641	125.741	283.799	126.600	125	
100	207.298	94.483	210.311	97.112	213.351	97.801	216.417	98.527	219.510	99.292	222.629	100.094	225.774	100.934	228.944	101.811	232.138	102.725	235.357	103.676	238.599	104.663	241.865	105.687	245.153	106.747	100	
90	191.406	87.680	194.468	88.600	197.559	89.362	200.680	90.167	203.829	91.013	207.005	91.900	210.209	92.829	213.440	93.798	216.696	94.808	219.978	95.858	223.285	96.948	226.616	98.077	229.970	99.245	90	50 (P)
80	175.408	79.433	178.230	80.240	181.885	81.094	185.070	81.994	188.286	82.941	191.531	83.933	194.805	84.970	198.107	86.053	201.436	87.180	204.792	88.350	208.173	89.565	211.579	90.822	215.009	92.122	80	30 (H)**
70	159.943	71.178	163.139	72.093	166.369	73.064	169.633	74.086	172.929	75.158	176.257	76.282	179.614	77.456	183.001	78.680	186.416	79.952	189.857	81.273	193.325	82.642	196.817	84.058	200.332	85.519	70	
60	144.464	62.205	147.552	64.265	151.077	65.383	154.437	66.563	157.831	67.799	161.257	69.092	164.714	70.441	168.200	71.844	171.713	73.302	175.253	74.813	178.818	76.376	182.406	77.989	186.015	79.652	60	40 (P)*
50	126.821	59.369	140.164	60.518	143.544	61.731	146.960	63.006	150.409	64.342	153.892	65.738	157.404	67.194	160.945	68.707	164.513	70.277	168.105	71.902	171.721	73.580	175.358	75.311	179.013	77.093	50	
45	120.261	55.671	132.665	56.924	136.106	58.245	139.584	59.633	143.095	61.085	146.637	62.601	150.209	64.179	153.807	65.818	157.430	67.515	161.076	69.269	164.741	71.078	168.425	72.940	172.123	74.854	45	40 (H)**
40	121.804	52.151	125.276	53.528	128.785	54.977	132.329	56.496	135.905	58.084	139.511	59.739	143.143	61.459	146.799	63.240	150.475	65.082	154.170	66.982	157.880	68.938	161.603	70.946	165.334	73.005	40	35 (P)*
35	114.479	48.864	118.022	50.392	121.604	51.993	125.218	53.668	128.861	55.415	132.528	57.233	136.218	59.113	139.925	61.058	143.647	63.063	147.379	65.126							35	30 (H)**
30	107.304	45.806	110.929	47.407	114.584	49.089	118.266	51.248	121.970	53.179	125.691	55.180															30	30 (P)*
25	100.406	44.837	104.142	46.619	111.825	48.482	115.531	50.422	119.254	52.435																	25	30 (H)**
23	100.317	43.388	104.016	45.303	107.735	47.298																					23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 118 Degrees

$\Delta = 118°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s		
metre																											metre	
2500	4168.203	2354.016	4170.707	2354.023	4173.215	2354.031	4175.723	2354.039	4178.230	2354.051	4180.742	2354.062	4183.254	2354.074	4185.766	2354.090	4188.281	2354.105	4190.797	2354.125	4193.316	2354.145	4195.832	2354.168	4198.352	2354.191	2500	
2200	3668.921	2071.535	3671.426	2071.543	3673.933	2071.551	3676.442	2071.563	3678.952	2071.574	3681.464	2071.586	3683.978	2071.602	3686.493	2071.621	3689.009	2071.641	3691.527	2071.660	3694.047	2071.684	3696.568	2071.707	3699.091	2071.734	2200	
2000	3336.066	1883.216	3338.572	1883.223	3341.080	1883.232	3343.589	1883.244	3346.101	1883.257	3348.614	1883.272	3351.128	1883.289	3353.645	1883.308	3356.163	1883.330	3358.682	1883.353	3361.204	1889.378	3363.728	1883.406	3366.252	1883.435	2000	
1800	3003.211	1694.896	3005.718	1694.905	3008.226	1694.915	3010.737	1694.927	3013.249	1694.942	3015.764	1694.959	3018.280	1694.978	3020.798	1694.999	3023.319	1695.023	3025.841	1695.048	3028.365	1695.077	3030.891	1693.107	3033.418	1695.139	1800	
1500	2503.929	1412.418	2506.437	1412.427	2508.947	1412.439	2511.460	1412.454	2513.975	1412.471	2516.492	1412.492	2519.012	1412.514	2521.534	1412.540	2524.058	1412.569	2526.584	1412.600	2529.114	1412.634	2531.645	1412.670	2534.178	1412.709	1500	
1200	2004.648	1129.939	2007.158	1129.951	2009.671	1129.967	2012.187	1129.985	2014.706	1130.007	2017.227	1130.032	2019.751	1130.061	2022.279	1130.093	2024.809	1130.128	2027.342	1130.167	2029.878	1130.209	2032.417	1130.255	2034.958	1130.304	1200	
1000	1671.794	941.622	1674.307	941.636	1676.823	941.654	1679.342	941.677	1681.864	941.703	1684.390	941.733	1686.919	941.768	1689.452	941.808	1691.988	941.848	1694.528	941.895	1697.071	941.945	1699.617	942.000	1702.167	942.059	1000	
900	1505.369	847.464	1507.882	847.479	1510.399	847.500	1512.920	847.524	1515.445	847.553	1517.974	847.587	1520.507	847.625	1523.043	847.668	1525.583	847.715	1528.127	847.767	1530.675	847.823	1533.227	847.884	1535.782	847.949	900	
800	1338.943	751.306	1341.458	753.323	1343.977	753.346	1346.501	753.374	1349.029	753.407	1351.561	753.445	1354.098	753.488	1356.639	753.536	1359.184	753.589	1361.734	753.647	1364.288	753.710	1366.846	753.778	1369.408	753.852	800	
700	1172.518	659.149	1175.035	659.169	1177.557	659.193	1180.084	659.226	1182.616	659.264	1185.153	659.307	1187.695	659.357	1190.242	659.411	1192.793	659.472	1195.350	659.539	1197.911	659.611	1200.478	659.689	1203.049	659.772	700	100 (P)*
600	1006.094	564.992	1008.614	565.016	1011.139	565.047	1013.671	565.083	1016.208	565.127	1018.751	565.178	1021.301	565.235	1023.855	565.299	1026.415	565.370	1028.981	565.448	1031.552	565.532	1034.130	565.623	1036.713	565.721	600	
500	839.671	470.838	842.195	470.867	844.726	470.903	847.264	470.947	849.809	471.000	852.360	471.061	854.919	471.129	857.484	471.206	860.056	471.291	862.635	471.385	865.221	471.485	867.813	471.594	870.413	471.712	500	
450	673.250	376.687	675.781	376.722	678.320	376.768	680.867	376.823	683.423	376.889	685.987	376.965	688.560	377.051	691.142	377.147	693.731	377.253	696.330	377.370	698.937	377.496	701.552	377.632	704.175	377.779	450	
400	606.684	339.028	609.217	339.067	611.760	339.118	614.313	339.180	616.875	339.253	619.447	339.337	622.028	339.432	624.618	339.539	627.218	339.657	629.827	339.786	632.445	339.926	635.073	340.078	637.710	340.241	400	
350	540.042	329.614	592.577	329.654	595.121	329.706	597.675	329.769	600.239	329.844	602.812	329.931	605.396	330.029	607.989	330.139	610.591	330.260	613.203	330.393	615.825	330.538	618.456	330.693	621.097	330.861	350	
300	506.835	282.542	509.376	282.589	511.927	282.650	514.490	282.724	517.065	282.812	519.651	282.912	522.248	283.027	524.856	283.156	527.475	283.296	530.105	283.451	532.747	283.620	535.400	283.802	538.063	283.997	300	80 (P)*
250	423.632	235.474	426.180	235.530	428.742	235.603	431.318	235.692	433.906	235.797	436.509	235.918	439.125	236.056	441.755	236.210	444.397	236.379	447.053	236.565	449.723	236.767	452.405	236.985	455.101	237.220	250	
230	390.352	216.648	392.904	216.709	395.471	216.789	398.053	216.885	400.650	217.000	403.261	217.132	405.887	217.281	408.528	217.448	411.183	217.632	413.852	217.834	416.535	218.054	419.233	218.291	421.945	218.545	230	
200	340.434	188.412	342.994	188.482	345.571	188.573	348.165	188.685	350.776	188.816	353.404	188.968	356.048	189.139	358.709	189.331	361.386	189.543	364.081	189.776	366.791	190.028	369.517	190.301	372.260	190.593	200	
175	290.519	160.180	293.089	160.263	295.680	160.370	298.291	160.501	300.921	160.655	303.571	160.834	306.240	161.036	308.928	161.261	311.636	161.511	314.363	161.784	317.109	162.081	319.874	162.401	322.657	162.745	175	65 (P)*
150	265.563	146.066	268.141	146.157	270.740	146.275	273.361	146.418	276.004	146.588	278.668	146.783	281.353	147.005	284.059	147.252	286.786	147.526	289.534	147.825	292.303	148.150	295.092	148.501	297.902	148.878	150	
125	215.659	117.846	218.255	117.939	220.877	118.105	223.527	118.283	226.203	118.493	228.905	118.735	231.633	119.010	234.386	119.316	237.166	119.655	239.970	120.026	242.800	120.428	245.654	120.863	248.533	121.329	125	
100	174.082	94.342	176.702	94.484	179.355	94.666	182.040	94.888	184.759	95.150	187.509	95.453	190.292	95.796	193.106	96.178	195.951	96.601	198.827	97.063	201.733	97.566	204.669	98.107	207.634	98.688	100	
90	157.457	84.947	160.089	85.104	162.738	85.306	165.464	85.553	168.205	85.844	170.983	86.180	173.795	86.561	176.642	86.985	179.523	87.454	182.437	87.968	185.385	88.524	188.365	89.125	191.376	89.769	90	50 (P)*
80	140.833	75.556	143.484	75.733	146.172	75.960	148.904	76.237	151.674	76.565	154.485	76.943	157.333	77.370	160.221	77.848	163.145	78.374	166.107	78.951	169.105	79.576	172.139	80.250	175.207	80.972	80	30 (H)**
70	124.219	66.172	126.889	66.274	129.603	66.434	132.367	66.951	135.174	67.325	138.026	67.756	140.921	68.244	143.859	68.788	146.839	69.389	149.860	70.046	152.921	70.758	156.021	71.525	159.159	72.347	70	
60	107.613	56.799	110.309	57.035	113.060	57.338	115.863	57.707	118.719	58.143	121.625	58.645	124.580	59.213	127.584	59.846	130.635	60.544	133.732	61.307	136.874	62.134	140.058	63.023	143.284	63.976	60	40 (P)*
50	99.314	52.119	102.028	52.376	104.800	52.706	107.630	53.109	110.515	53.584	113.455	54.131	116.448	54.749	119.493	55.438	122.588	56.198	125.731	57.028	128.922	57.926	132.158	58.892	135.437	59.926	50	
45	91.020	47.444	93.755	47.726	96.533	48.089	99.413	48.332	102.334	49.054	105.314	49.654	108.351	50.333	111.444	51.089	114.589	51.922	117.787	52.831	121.034	53.814	124.328	54.871	127.668	56.001	45	40 (H)**
40	82.732	42.776	85.491	43.090	88.321	43.493	91.219	43.984	94.182	44.563	97.210	45.228	100.299	45.980	103.448	46.817	106.654	47.739	109.914	48.742	113.226	49.828	116.586	50.995	119.997	52.238	40	35 (P)*
35	74.452	38.119	77.242	38.471	80.110	38.924	83.054	39.475	86.069	40.125	89.155	40.871	92.307	41.714	95.523	42.650	98.800	43.680	102.135	44.801	105.523	46.011	108.963	47.300	112.450	48.669	35	35 (H) 30 (P)*
30	66.183	33.475	69.013	33.878	71.929	34.394	74.930	35.023	78.010	35.782	81.167	36.612	84.397	37.568	87.695	38.631	91.056	39.796	94.478	41.062	97.956	42.427	101.484	43.886	105.059	45.438	30	
28	62.880	31.624	65.728	32.090	68.668	32.597	71.696	33.263	74.807	34.046	77.997	34.944	81.262	35.956	84.598	37.078	87.998	38.308	91.459	39.642	94.975	41.079	98.542	42.614	102.153	44.244	33	
25	57.932	28.854	60.812	29.323	63.792	29.923	66.866	30.654	70.029	31.512	73.276	32.495	76.601	33.600	79.998	34.825	83.462	36.165	86.986	37.617	90.564	39.176	94.190	40.838	97.858	42.598	30	30 (H)**
23	52.907	25.265	52.657	24.827	55.722	25.543	58.893	26.415	62.164	27.436	65.526	28.681	68.970	29.907	72.488	31.347	76.072	32.917	79.711	34.609	83.396	36.416	87.120	38.332	90.871	40.348	23	
22	46.428	22.445	49.414	23.034	52.521	23.832	55.741	24.775	59.064	25.878	62.481	27.135	65.980	28.541	69.553	30.089	73.187	31.770	76.873	33.577	80.599	35.502	84.354	37.535			22	25 (P)*
20	41.527	19.738	44.577	20.496	47.762	21.325	51.067	22.400	54.481	23.654	57.991	25.078	61.591	26.663	65.239	28.399	68.949	30.274	72.697	32.278							20	25 (H)**
15	33.433	15.327	36.638	16.247	39.999	17.413	43.493	18.808	47.095	20.419	50.780	22.226	54.522	24.209													15	20 (P)*
14	31.832	14.469	35.078	15.452	38.444	16.693	42.023	18.175	45.667	19.879	49.366	21.783															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 118 Degrees

$\Delta = 118°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	4200.875	2354.215	4203.398	2354.242	4205.922	2354.270	4208.449	2354.301	4210.977	2354.333	4213.504	2354.367	4216.031	2354.402	4218.562	2354.437	4221.098	2354.477	4223.633	2354.516	4226.168	2354.555	4228.703	2354.598	4231.242	2354.645	2500	
2200	3701.615	3071.782	3704.141	2071.793	3706.668	2071.824	3709.198	2071.859	3711.728	2071.895	3714.260	2071.934	3716.794	2071.973	3719.329	2072.016	3721.866	2072.059	3724.405	2072.102	3726.945	2072.148	3729.486	2072.199	3732.029	2072.250	2200	
2000	3364.779	1883.466	3371.308	1883.500	3373.838	1883.535	3376.370	1883.572	3378.904	1883.612	3381.439	1883.653	3383.976	1883.697	3386.515	1883.742	3389.056	1883.790	3391.598	1883.839	3394.142	1883.891	3396.687	1883.944	3399.234	1884.000	2000	
1800	3033.948	1695.174	3036.480	1695.211	3041.013	1695.251	3043.549	1695.292	3046.086	1695.336	3048.623	1695.382	3051.167	1695.430	3053.710	1695.481	3056.255	1695.534	3058.802	1695.589	3061.350	1695.646	3063.901	1695.706	3066.454	1695.767	1800	
1600	2536.713	1412.750	2539.251	1412.795	2541.791	1412.843	2544.334	1412.892	2546.879	1412.945	2549.426	1413.000	2551.976	1413.058	2554.527	1413.119	2557.081	1413.182	2559.637	1413.248	2562.196	1413.317	2564.756	1413.388	2567.319	1413.463	1600	
1400	2037.503	1130.356	2040.051	1130.412	2042.601	1130.470	2045.154	1130.532	2047.710	1130.598	2050.269	1130.668	2052.830	1130.740	2055.395	1130.816	2057.962	1130.895	2060.532	1130.978	2063.105	1131.063	2065.681	1131.153	2068.259	1131.246	1400	
1200	1704.729	942.121	1707.278	942.188	1709.838	942.259	1712.401	942.334	1714.969	942.413	1717.538	942.495	1720.112	942.583	1722.690	942.674	1725.270	942.768	1727.854	942.867	1730.442	942.971	1733.032	943.078	1735.626	943.189	1200	
1000	1538.342	848.019	1540.905	848.093	1543.471	848.171	1546.042	848.254	1548.616	848.342	1551.194	848.434	1553.776	848.531	1556.362	848.632	1558.952	848.737	1561.545	848.847	1564.142	848.962	1566.742	849.081	1569.347	849.205	1000	
900	1371.574	753.920	1374.565	754.013	1377.121	754.105	1379.700	754.195	1382.283	754.294	1384.871	754.398	1387.463	754.506	1390.059	754.620	1392.660	754.739	1395.265	754.863	1397.873	754.991	1400.486	755.125	1403.104	755.264	900	
800	1203.025	659.862	1208.206	659.937	1210.792	660.019	1213.382	660.108	1215.977	660.278	1218.577	660.396	1221.182	660.521	1223.792	660.651	1226.407	660.786	1229.026	660.928	1231.650	661.075	1234.279	661.228	1236.913	661.387	800	
700	1039.301	565.825	1041.895	565.936	1044.495	566.054	1047.100	566.179	1049.711	566.310	1052.328	566.448	1054.950	566.593	1057.578	566.745	1060.211	566.903	1062.850	567.068	1065.494	567.240	1068.144	567.419	1070.800	567.604	700	
650	873.018	471.837	875.631	471.970	878.250	472.112	880.877	472.262	883.509	472.419	886.149	472.585	888.795	472.759	891.448	472.941	894.107	473.131	896.773	473.328	899.445	473.535	902.125	473.749	904.810	473.971	650	
600	706.807	377.986	709.448	378.102	712.096	378.229	714.753	378.366	717.418	378.513	720.092	378.670	722.773	379.087	725.463	379.314	728.161	379.552	730.867	379.799	733.582	380.056	736.304	380.324	739.035	380.602	600	
550	640.356	340.415	643.011	340.600	645.677	340.797	648.350	341.004	651.033	341.223	653.726	341.453	656.427	341.694	659.137	341.947	661.856	342.210	664.584	342.485	667.322	342.771	670.067	343.068	672.823	343.376	550	100 (P)*
500	573.748	303.040	626.407	331.230	629.077	331.432	631.756	331.646	634.446	331.871	637.141	332.108	639.848	332.356	642.564	332.615	645.289	332.886	648.023	333.169	650.767	333.463	653.520	333.768	656.282	334.085	500	
450	540.799	284.206	543.424	284.428	546.121	284.664	548.829	284.913	551.547	285.175	554.276	285.451	557.016	285.740	559.766	286.043	562.528	286.359	565.299	286.688	568.082	287.031	570.875	287.387	573.679	287.757	450	
400	457.809	237.470	460.531	237.737	463.265	238.019	466.013	238.318	468.773	238.632	471.546	238.963	474.332	239.310	477.130	239.672	479.941	240.051	482.764	240.446	485.600	240.857	488.448	241.283	491.309	241.726	400	
350	424.671	318.818	427.412	219.107	430.166	219.414	432.934	219.739	435.716	220.080	438.511	220.440	441.320	220.816	444.143	221.210	446.979	221.622	449.829	222.050	452.692	222.496	455.569	222.960	458.458	223.440	350	80 (P)*
300	373.015	190.566	377.793	191.278	380.582	191.591	383.390	191.564	386.211	192.337	389.040	192.769	391.901	193.202	394.770	193.655	397.653	194.127	400.552	194.619	403.465	195.131	406.394	195.663	409.337	196.214	300	
250	325.455	163.112	328.286	163.503	331.118	163.918	333.975	164.355	336.850	164.817	339.743	165.302	342.653	165.809	345.582	166.341	348.527	166.895	351.490	167.472	354.470	168.073	357.467	168.697	360.480	169.344	250	
200	300.771	149.281	303.581	149.709	306.450	150.164	309.339	150.643	312.248	151.149	315.175	151.679	318.122	152.236	321.088	152.817	324.073	153.424	327.076	154.057	330.098	154.714	333.137	155.397	336.195	156.104	200	65 (P)*
175	251.436	121.827	254.363	122.357	257.314	122.919	260.288	123.511	263.285	124.136	266.305	124.791	269.348	125.478	272.413	126.195	275.500	126.944	278.609	127.723	281.739	128.533	284.890	129.374	288.062	130.244	175	
150	210.620	99.308	213.651	99.908	216.702	100.666	219.781	101.403	222.887	102.179	226.020	102.992	229.179	103.844	232.363	104.734	235.573	105.661	238.808	106.626	242.067	107.628	245.350	108.667	248.656	109.742	150	
125	194.826	90.457	197.496	91.187	200.598	91.961	203.732	92.777	206.896	93.633	210.087	94.535	213.307	95.477	216.554	96.460	219.828	97.485	223.128	98.550	226.453	99.656	229.803	100.801	233.177	101.987	125	50 (P)
100	178.310	81.743	181.446	82.561	184.614	83.428	187.815	84.341	191.046	85.301	194.309	86.307	197.600	87.360	200.921	88.458	204.269	89.601	207.645	90.789	211.044	92.021	214.474	93.297	217.926	94.616	100	
90	161.333	73.323	163.547	74.153	168.794	75.137	171.075	76.173	173.389	77.261	175.735	78.401	178.113	79.592	180.524	80.834	182.966	82.125	185.440	83.465	187.945	84.853	190.481	86.289	193.048	87.772	90	30 (H)**
80	146.552	64.990	149.158	66.065	151.802	67.201	154.482	68.396	157.198	69.650	159.950	70.962	162.738	72.330	165.562	73.754	168.422	75.233	171.318	76.766	174.250	78.351	177.218	79.988	180.221	81.675	80	
70	130.759	61.038	133.396	62.192	136.071	63.422	138.784	64.715	141.535	66.071	144.324	67.487	147.150	68.964	150.014	70.499	152.916	72.091	155.856	73.740	158.834	75.443	161.850	77.199	164.904	79.006	70	
60	114.981	57.282	117.615	58.473	120.286	59.813	122.995	61.221	125.742	62.694	128.527	64.232	131.350	65.833	134.211	67.495	137.111	69.217	140.049	70.996	143.026	72.832	146.041	74.721	149.095	76.663	60	40 (H)**
50	99.204	53.559	101.835	54.955	104.503	56.425	107.209	57.967	109.953	59.578	112.735	61.257	115.556	63.001	118.415	64.808	121.313	66.677	124.250	68.604	127.226	70.588	130.241	72.626	133.295	74.715	50	35 (P)*
45	91.281	50.156	93.911	51.701	96.578	53.328	99.283	55.025	102.027	56.797	104.809	58.639	107.630	60.549	110.489	62.522	113.387	64.556	116.324	66.648							45	30 (P)*
40	83.358	47.078	85.988	48.504	88.655	50.011	91.360	51.728	94.104	52.497	96.886	54.457	99.707	56.487													40	30 (H)**
35	75.435	43.965	78.065	45.363	80.732	47.772	83.437	48.662	86.181	51.631	88.963	53.673															35	30 (H)**
30	67.512	40.851	70.142	42.451	72.809	44.451	75.514	46.393	78.258	48.417																	30	30 (H)**
25																											25	
23																											23	25 (P)*
22																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 16 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 119 Degrees

$\Delta = 119°$

R_c	L_s=15 metres	L_s=20 metres	L_s=25 metres	L_s=30 metres	L_s=35 metres	L_s=40 metres	L_s=45 metres	L_s=50 metres	L_s=55 metres	L_s=60 metres	L_s=65 metres	L_s=70 metres	L_s=75 metres	R_c	Speed km/h
	T_s E_s	T_s E_s	T_s E_s	T_s E_s	T_s E_s	T_s E_s	T_s E_s	T_s E_s	T_s E_s	T_s E_s	T_s E_s	T_s E_s	T_s E_s	metre	
2500	4251.656 2425.738	4254.164 2425.742	4256.668 2425.750	4259.176 2425.758	4261.688 2425.770	4264.195 2425.781	4266.707 2425.797	4269.223 2425.812	4271.738 2425.828	4274.254 2425.848	4276.770 2425.867	4279.289 2425.891	4281.809 2425.914	2500	
2200	3742.360 2134.652	3744.866 2134.656	3767.373 2134.664	3749.882 2134.676	3752.392 2134.688	3754.904 2134.703	3757.418 2134.719	3759.933 2134.734	3762.450 2134.754	3764.968 2134.777	3767.489 2134.801	3770.010 2134.824	3772.533 2134.852	2200	
2000	3402.829 1940.593	3405.335 1940.601	3407.843 1940.610	3410.353 1940.621	3412.865 1940.635	3415.378 1940.650	3417.893 1940.667	3420.409 1940.687	3422.927 1940.708	3425.448 1940.732	3427.970 1940.758	3430.494 1940.785	3433.019 1940.815	2000	
1800	3063.298 1746.536	3065.804 1746.544	3068.313 1746.554	3070.824 1746.567	3073.337 1746.582	3075.852 1746.599	3078.368 1746.618	3080.887 1746.640	3083.407 1746.664	3085.930 1746.690	3088.455 1746.719	3090.981 1746.750	3093.509 1746.782	1800	
1500	2554.001 1455.451	2556.510 1455.460	2559.020 1455.472	2561.533 1455.487	2564.048 1455.504	2566.566 1455.526	2569.086 1455.549	2571.608 1455.575	2574.133 1455.604	2576.660 1455.635	2579.189 1455.669	2581.721 1455.707	2584.255 1455.746	1500	
1200	2044.706 1164.366	2047.216 1164.378	2049.729 1164.393	2052.246 1164.412	2054.765 1164.434	2057.287 1164.460	2059.812 1164.489	2062.340 1164.522	2064.870 1164.557	2067.404 1164.597	2069.941 1164.640	2072.480 1164.686	2075.023 1164.735	1200	
1000	1705.176 970.310	1707.689 970.325	1710.205 970.344	1712.724 970.366	1715.247 970.393	1717.773 970.423	1720.303 970.458	1722.837 970.498	1725.374 970.540	1727.914 970.587	1730.458 970.639	1733.005 970.694	1735.557 970.754	1000	
900	1535.412 873.283	1537.926 873.300	1540.444 873.320	1542.965 873.345	1545.490 873.375	1548.020 873.409	1550.553 873.448	1553.090 873.491	1555.632 873.539	1558.176 873.591	1560.725 873.648	1563.278 873.710	1565.834 873.776	900	
800	1365.648 776.257	1368.164 776.275	1370.684 776.298	1373.208 776.326	1375.736 776.359	1378.269 776.398	1380.807 776.441	1383.349 776.490	1385.895 776.544	1388.445 776.603	1391.000 776.667	1393.559 776.736	1396.123 776.811	800	
700	1195.885 679.231	1198.403 679.252	1200.925 679.278	1203.453 679.310	1205.986 679.348	1208.523 679.392	1211.066 679.442	1213.614 679.497	1216.166 679.559	1218.723 679.627	1221.287 679.700	1223.855 679.779	1226.427 679.864	700	100 (P)*
600	1026.123 582.206	1028.644 582.230	1031.170 582.261	1033.702 582.298	1036.240 582.343	1038.784 582.394	1041.334 582.452	1043.889 582.517	1046.451 582.589	1049.018 582.668	1051.591 582.755	1054.170 582.846	1056.755 582.945	600	
500	856.362 485.183	858.887 485.212	861.418 485.249	863.957 485.294	866.503 485.347	869.056 485.409	871.615 485.479	874.182 485.556	876.755 485.643	879.336 485.737	881.923 485.840	884.518 485.950	887.119 486.070	500	
400	686.604 388.163	689.135 388.199	691.674 388.243	694.223 388.302	696.780 388.368	699.345 388.445	701.920 388.532	704.503 388.630	707.094 388.737	709.695 388.856	712.304 388.984	714.921 389.122	717.548 389.271	400	
360	618.702 349.357	621.226 349.396	623.780 349.448	626.334 349.510	628.897 349.585	631.470 349.670	634.053 349.767	636.645 349.875	639.247 349.995	641.858 350.126	644.479 350.268	647.109 350.422	649.749 350.588	360	
320	601.727 339.655	604.262 339.696	606.807 339.749	609.362 339.813	611.927 339.889	614.502 339.978	617.087 340.077	619.682 340.189	622.287 340.312	624.901 340.447	627.526 340.593	630.159 340.751	632.803 340.921	320	
300	516.831 291.447	519.392 291.197	521.945 291.259	524.509 291.334	527.085 291.423	529.672 291.525	532.271 291.642	534.882 291.772	537.503 291.915	540.136 292.072	542.781 292.244	545.437 292.428	548.104 292.626	300	80 (P)*
280	431.979 242.647	434.528 242.704	437.091 242.778	439.668 242.868	442.259 242.975	444.864 243.098	447.482 243.238	450.114 243.394	452.760 243.566	455.419 243.755	458.092 243.959	460.778 244.181	463.477 244.419	280	
260	398.031 223.249	400.584 223.310	403.153 223.390	405.737 223.488	408.335 223.604	410.949 223.738	413.577 223.890	416.221 224.059	418.879 224.246	421.551 224.451	424.239 224.674	426.940 224.915	429.657 225.173	260	
240	347.111 194.151	349.673 194.223	352.251 194.315	354.847 194.428	357.461 194.561	360.091 194.715	362.739 194.889	365.403 195.084	368.084 195.299	370.782 195.535	373.496 195.791	376.228 196.068	378.975 196.365	240	
220	296.195 165.038	298.768 165.143	301.360 165.251	303.973 165.384	306.606 165.541	309.259 165.722	311.931 165.927	314.624 166.156	317.336 166.409	320.068 166.686	322.818 166.987	325.589 167.312	328.378 167.661	220	65 (P)*
200	270.740 150.514	273.318 150.607	275.920 150.726	278.543 150.872	281.189 151.044	283.856 151.242	286.545 151.467	289.255 151.718	291.988 151.996	294.741 152.300	297.515 152.630	300.310 152.986	303.126 153.368	200	
180	219.824 121.454	222.432 121.549	225.057 121.697	227.709 121.877	230.389 122.090	233.095 122.336	235.828 122.615	238.587 122.926	241.372 123.270	244.183 123.646	247.020 124.055	249.881 124.496	252.768 124.969	180	
160	177.424 97.214	180.046 97.357	182.701 97.542	185.391 97.767	188.114 98.034	190.870 98.341	193.658 98.689	196.479 99.077	199.331 99.506	202.215 99.975	205.129 100.485	208.075 101.034	211.050 101.624	160	
140	160.464 87.531	163.100 87.691	165.772 87.896	168.482 88.146	171.229 88.442	174.012 88.783	176.831 89.169	179.685 89.600	182.574 90.076	185.497 90.597	188.454 91.162	191.444 91.772	194.467 92.426	140	50 (P)*
120	143.510 77.854	146.161 78.034	148.855 78.264	151.590 78.546	154.366 78.878	157.183 79.262	160.039 79.696	162.934 80.180	165.868 80.715	168.840 81.299	171.849 81.934	174.894 82.617	177.975 83.351	120	50 (H)**
100	126.561 68.184	129.223 68.389	131.954 68.653	134.721 68.974	137.535 69.354	140.394 69.791	143.298 70.287	146.245 70.839	149.235 71.449	152.268 72.113	155.341 72.838	158.454 73.616	161.607 74.450	100	
90	109.621 58.523	112.321 58.764	115.077 59.071	117.887 59.446	120.750 59.889	123.665 60.398	126.630 60.974	129.645 61.617	132.708 62.326	135.818 63.100	138.973 63.938	142.173 64.841	145.416 65.807	90	40 (P)*
85	101.156 53.702	103.874 53.962	106.652 54.297	109.489 54.706	112.382 55.188	115.332 55.743	118.333 56.371	121.392 57.070	124.500 57.841	127.657 58.683	130.863 59.594	134.116 60.575	137.413 61.624	85	
80	92.695 48.884	95.435 49.170	98.239 49.538	101.107 49.988	104.037 50.517	107.027 51.127	110.076 51.816	113.182 52.583	116.342 53.428	119.505 54.350	122.818 55.348	126.031 56.421	129.491 57.567	80	40 (H)**
75	84.241 44.073	87.006 44.392	89.842 44.800	92.748 45.299	95.722 45.886	98.761 46.562	101.863 47.325	105.026 48.174	108.248 49.109	111.526 50.128	114.857 51.229	118.239 52.412	121.669 53.674	75	35 (P)*
70	75.795 39.273	78.591 39.631	81.467 40.090	84.420 40.650	87.447 41.309	90.545 42.066	93.712 42.921	96.944 43.872	100.239 44.916	103.592 46.054	107.002 47.281	110.464 48.598	113.975 50.001	70	35 (H) 30 (P)*
65	67.361 34.487	70.197 34.896	73.123 35.420	76.134 36.057	79.227 36.808	82.399 37.670	85.644 38.641	88.960 39.718	92.342 40.901	95.786 42.186	99.287 43.571	102.840 45.052	106.441 46.626	65	
60	63.991 32.578	66.847 33.011	69.796 33.567	72.835 34.242	75.960 35.037	79.165 35.948	82.448 36.975	85.802 38.113	89.224 39.361	92.708 40.716	96.249 42.174	99.842 43.731	103.481 45.385	60	30 (H)**
55	58.944 29.723	61.832 30.199	64.822 30.809	67.909 31.550	71.087 32.421	74.350 33.418	77.694 34.540	81.113 35.783	84.600 37.143	88.149 38.616	91.754 40.198	95.408 41.884	99.106 43.671	55	
50	50.554 24.992	53.514 25.563	56.591 26.291	59.777 27.175	63.066 28.210	66.447 29.393	69.914 30.718	73.457 32.180	77.067 33.772	80.736 35.489	84.452 37.323	88.208 39.267	91.994 41.313	50	
45	47.209 23.117	50.205 23.735	53.326 24.524	56.562 25.481	59.904 26.600	63.343 27.876	66.866 29.303	70.466 30.873	74.129 32.579	77.846 34.413	81.605 36.366	85.393 38.429		45	25 (P)*
40	42.210 20.325	45.273 21.033	48.472 21.936	51.796 23.027	55.232 24.299	58.766 25.744	62.383 27.352	66.071 29.114	69.813 31.017	73.595 33.051				40	25 (H)**
35	33.954 15.775	37.175 16.709	40.556 17.891	44.074 19.308	47.704 20.942	51.420 22.776	55.196 24.788							35	20 (P)*
30	32.321 14.890	35.584 15.887	39.012 17.146	42.577 18.650	46.250 20.382	50.001 22.311								30	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 119 Degrees

$\Delta = 119°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre			
2500	4284.332	2425.941	4286.855	2425.969	4289.379	2425.996	4291.906	2426.027	4294.434	2426.059	4296.965	2426.094	4299.492	2426.129	4302.023	2426.164	4304.559	2426.203	4307.094	2426.242	4309.629	2426.285	4312.168	2426.328	4314.707	2426.375	2500	
2200	3773.058	2134.883	3777.583	2134.910	3780.113	2134.945	3782.642	2134.980	3785.174	2135.016	3787.706	2135.055	3790.241	2135.094	3792.777	2135.137	3795.314	2135.180	3797.854	2135.227	3800.394	2135.273	3802.937	2135.324	3805.480	2135.375	2200	
2000	3435.547	1940.847	3438.076	1940.881	3440.606	1940.917	3443.139	1940.955	3445.673	1940.994	3448.210	1941.037	3450.748	1941.081	3453.287	1941.127	3455.829	1941.175	3458.371	1941.225	3460.916	1941.278	3463.463	1941.332	3466.011	1941.388	2000	
1800	3096.040	1746.818	3098.572	1746.855	3101.106	1746.895	3103.643	1746.938	3106.180	1746.982	3108.720	1747.028	3111.262	1747.077	3113.807	1747.129	3116.353	1747.182	3118.900	1747.238	3121.450	1747.296	3124.002	1747.357	3126.555	1747.419	1800	
1500	2586.792	1455.788	2589.330	1455.833	2591.872	1455.882	2594.415	1455.932	2596.960	1455.986	2599.508	1456.041	2602.059	1456.101	2604.612	1456.162	2607.167	1456.226	2609.724	1456.293	2612.283	1456.363	2614.845	1456.435	2617.410	1456.511	1500	
1200	2077.568	1164.788	2080.117	1164.845	2082.668	1164.905	2085.222	1164.968	2087.779	1165.034	2090.339	1165.105	2092.902	1165.178	2095.468	1165.255	2098.036	1165.336	2100.608	1165.419	2103.182	1165.506	2105.760	1165.597	2108.340	1165.691	1200	
1000	1738.111	970.817	1740.669	970.885	1743.230	970.957	1745.795	971.033	1748.364	971.113	1750.935	971.197	1753.511	971.285	1756.090	971.378	1758.672	971.474	1761.257	971.574	1763.847	971.679	1766.439	971.788	1769.035	971.901	1000	
900	1568.395	873.847	1570.959	873.922	1573.527	874.002	1576.099	874.086	1578.675	874.175	1581.255	874.268	1583.838	874.366	1586.426	874.469	1589.017	874.576	1591.612	874.688	1594.211	874.804	1596.814	874.925	1599.420	875.050	900	
800	1398.691	776.890	1401.263	776.975	1403.840	777.065	1406.421	777.160	1409.006	777.260	1411.596	777.365	1414.189	777.475	1416.788	777.591	1419.390	777.711	1421.997	777.837	1424.608	777.967	1427.223	778.104	1429.843	778.244	800	
700	1229.004	679.955	1231.587	680.052	1234.175	680.155	1236.767	680.263	1239.364	680.377	1241.966	680.497	1244.573	680.623	1247.186	680.755	1249.802	680.893	1252.424	681.036	1255.051	681.186	1257.682	681.341	1260.319	681.502	700	
600	1059.345	583.051	1061.941	583.164	1064.543	583.283	1067.150	583.410	1069.763	583.543	1072.382	583.683	1075.007	583.831	1077.637	583.984	1080.273	584.145	1082.915	584.312	1085.562	584.487	1088.216	584.668	1090.874	584.855	600	
500	889.727	486.197	892.342	486.332	894.964	486.476	897.593	486.628	900.228	486.787	902.870	486.956	905.519	487.132	908.175	487.316	910.838	487.509	913.507	487.710	916.183	487.919	918.866	488.137	921.555	488.362	500	
400	720.182	389.430	722.825	389.599	725.477	389.778	728.137	389.968	730.805	390.168	733.483	390.378	736.168	390.598	738.862	390.829	741.564	391.070	744.274	391.321	746.993	391.582	749.720	391.854	752.455	392.135	400	100 (P)*
360	652.398	350.764	655.057	350.952	657.725	351.151	660.402	351.362	663.089	351.584	665.785	351.818	668.491	352.063	671.205	352.318	673.929	352.586	676.662	352.864	679.404	353.155	682.155	353.456	684.916	353.769	360	
350	635.457	341.103	638.120	341.296	640.792	341.501	643.475	341.718	646.167	341.946	648.868	342.186	651.579	342.438	654.300	342.701	657.029	342.976	659.769	343.263	662.518	343.562	665.276	343.871	668.043	344.193	350	
300	550.781	292.838	553.472	293.063	556.173	293.302	558.885	293.555	561.607	293.821	564.341	294.101	567.086	294.395	569.842	294.702	572.609	295.022	575.386	295.357	578.175	295.705	580.974	296.066	583.784	296.441	300	
250	466.190	244.673	468.916	244.943	471.656	245.230	474.408	245.533	477.174	245.852	479.952	246.188	482.744	246.540	485.549	246.908	488.366	247.292	491.196	247.693	494.039	248.109	496.895	248.542	499.763	248.991	250	
230	432.388	225.449	435.133	225.743	437.892	226.054	440.666	226.384	443.454	226.730	446.255	227.095	449.071	227.477	451.900	227.877	454.744	228.295	457.601	228.730	460.472	229.182	463.356	229.652	466.254	230.140	230	80 (P)*
200	381.739	196.682	384.519	197.019	387.316	197.377	390.128	197.756	392.957	198.154	395.802	198.573	398.662	199.012	401.538	199.471	404.429	199.950	407.336	200.450	410.259	200.969	413.196	201.509	416.149	202.069	200	
170	331.186	168.034	334.013	168.431	336.859	168.852	339.724	169.296	342.607	169.764	345.508	170.256	348.427	170.771	351.364	171.310	354.319	171.873	357.292	172.459	360.282	173.068	363.290	173.701	366.315	174.358	170	
155	305.962	153.777	308.820	154.212	311.697	154.673	314.594	155.159	317.511	155.672	320.448	156.211	323.405	156.775	326.380	157.365	329.375	157.981	332.390	158.623	335.422	159.290	338.474	159.983	341.544	160.701	155	65 (P)*
125	255.680	125.474	258.616	126.012	261.576	126.582	264.561	127.183	267.569	127.817	270.600	128.482	273.655	129.179	276.732	129.907	279.832	130.666	282.954	131.457	286.098	132.279	289.263	133.132	292.450	134.016	125	
100	214.055	102.253	217.089	102.923	220.152	103.631	223.244	104.379	226.363	105.166	229.510	105.992	232.683	106.856	235.883	107.759	239.109	108.700	242.361	109.679	245.637	110.696	248.938	111.750	252.262	112.841	100	
90	197.522	93.123	200.609	93.864	203.727	94.649	206.875	95.477	210.053	96.348	213.260	97.262	216.496	98.218	219.760	99.215	223.051	100.255	226.369	101.336	229.713	102.458	233.083	103.621	236.478	104.824	90	50 (P)
80	181.099	84.133	184.240	84.963	187.424	85.842	190.640	86.769	193.888	87.745	197.168	88.765	200.478	89.833	203.817	90.947	207.185	92.107	210.581	93.313	214.004	94.563	217.453	95.857	220.928	97.196	80	50 (H)**
70	164.797	75.339	168.025	76.243	171.289	77.281	174.588	78.333	177.921	79.437	181.287	80.594	184.685	81.802	188.113	83.062	191.572	84.372	195.059	85.732	198.573	87.141	202.114	88.599	205.680	90.103	70	
60	148.701	66.837	152.025	67.928	155.389	69.080	158.789	70.293	162.225	71.566	165.696	72.897	169.199	74.285	172.733	75.731	176.297	77.231	179.889	78.787	183.507	80.396	187.150	82.057	190.817	83.769	60	40 (P)*
55	140.754	62.741	144.136	63.923	147.558	65.172	151.017	66.484	154.513	67.860	158.043	69.297	161.606	70.796	165.199	72.353	168.821	73.969	172.469	75.642	176.142	77.370	179.839	79.152	183.556	80.986	55	
50	132.895	58.786	136.341	60.076	139.828	61.436	143.353	62.864	146.914	64.360	150.509	65.920	154.135	67.545	157.790	69.232	161.471	70.979	165.177	72.784	168.905	74.647	172.652	76.564	176.417	78.535	50	40 (H)**
45	125.145	55.013	128.664	56.432	132.223	57.924	135.819	59.488	139.450	61.123	143.113	62.827	146.804	64.597	150.521	66.431	154.261	68.327	158.021	70.283	161.798	72.296	165.589	74.364	169.392	76.484	45	35 (P)*
40	117.532	51.488	121.130	53.056	124.767	54.704	128.439	56.429	132.142	58.227	135.872	60.097	139.626	62.034	143.400	64.037	147.191	66.101	150.994	68.224							40	30 (H)**
35	110.086	48.291	113.769	50.042	117.486	51.876	121.232	53.790	125.002	55.779	128.792	57.839															35	
33	107.162	47.131	110.879	48.966	114.627	50.884	118.400	52.881	122.192	54.954																	33	30 (P)*
30	102.841	45.551	106.605	47.522	110.393	49.576																					30	30 (H)**
25																											25	
23																											23	28 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 120 Degrees

$\Delta = 120°$

R_c	L_s=15 metres		L_s=20 metres		L_s=25 metres		L_s=30 metres		L_s=35 metres		L_s=40 metres		L_s=45 metres		L_s=50 metres		L_s=55 metres		L_s=60 metres		L_s=65 metres		L_s=70 metres		L_s=75 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	4337.633	2500.004	4340.137	2500.012	4342.645	2500.020	4345.152	2500.027	4347.660	2500.039	4350.172	2500.051	4352.684	2500.066	4355.193	2500.082	4357.711	2500.098	4360.230	2500.117	4362.746	2500.137	4365.266	2500.160	4367.789	2500.184	2500	
2200	3818.017	2200.008	3820.523	2200.012	3823.030	2200.020	3825.540	2200.031	3828.050	2200.043	3830.562	2200.059	3833.076	2200.074	3835.592	2200.094	3838.109	2200.113	3840.628	2200.133	3843.148	2200.156	3845.670	2200.184	3848.194	2200.211	2200	
2000	3471.608	2000.007	3474.114	2000.015	3476.622	2000.024	3479.132	2000.036	3481.644	2000.049	3484.158	2000.065	3486.673	2000.083	3489.190	2000.102	3491.709	2000.124	3494.229	2000.148	3496.752	2000.174	3499.276	2000.202	3501.802	2000.232	2000	
1800	3125.199	1800.009	3127.706	1800.017	3130.215	1800.027	3132.726	1800.040	3135.239	1800.055	3137.754	1800.073	3140.271	1800.092	3142.790	1800.114	3145.311	1800.138	3147.834	1800.165	3150.359	1800.194	3152.886	1800.225	3155.415	1800.259	1800	
1500	2605.586	1500.011	2608.094	1500.021	2610.603	1500.033	2613.118	1500.048	2615.634	1500.066	2618.152	1500.087	2620.672	1500.111	2623.195	1500.137	2625.720	1500.167	2628.248	1500.199	2630.778	1500.233	2633.310	1500.271	2635.845	1500.311	1500	
1200	2085.973	1200.014	2088.484	1200.027	2090.998	1200.042	2093.514	1200.061	2096.033	1200.084	2098.556	1200.110	2101.082	1200.139	2103.610	1200.173	2106.141	1200.209	2108.676	1200.249	2111.213	1200.292	2113.754	1200.339	2116.297	1200.389	1200	
1000	1739.566	1000.018	1742.079	1000.032	1744.595	1000.051	1747.115	1000.074	1749.638	1000.101	1752.165	1000.132	1754.696	1000.168	1757.230	1000.208	1759.767	1000.251	1762.309	1000.299	1764.854	1000.351	1767.402	1000.407	1769.954	1000.468	1000	
900	1564.363	900.020	1568.877	900.036	1571.395	900.057	1573.917	900.083	1576.443	900.112	1578.973	900.147	1581.507	900.187	1584.045	900.230	1586.587	900.279	1589.133	900.333	1591.682	900.390	1594.236	900.453	1596.794	900.520	900	
800	1393.160	800.023	1395.676	800.041	1398.196	800.064	1400.721	800.093	1403.250	800.127	1405.784	800.166	1408.322	800.210	1410.865	800.260	1413.412	800.314	1415.963	800.374	1418.519	800.439	1421.080	800.510	1423.645	800.585	800	
700	1219.958	700.026	1222.476	700.047	1224.999	700.073	1227.527	700.106	1230.061	700.145	1232.599	700.190	1235.143	700.240	1237.691	700.297	1240.245	700.359	1242.804	700.428	1245.368	700.502	1247.937	700.583	1250.511	700.669	700	100 (P)*
600	1046.757	600.031	1049.278	600.055	1051.803	600.086	1054.338	600.125	1056.877	600.169	1059.422	600.222	1061.973	600.281	1064.529	600.347	1067.092	600.419	1069.661	600.500	1072.235	600.586	1074.815	600.680	1077.402	600.781	600	
500	873.558	500.037	876.083	500.066	878.615	500.104	881.154	500.149	883.701	500.204	886.255	500.266	888.816	500.337	891.384	500.416	893.959	500.503	896.541	500.600	899.130	500.704	901.726	500.816	904.329	500.937	500	
450	700.361	400.046	702.892	400.083	705.432	400.130	707.982	400.187	710.540	400.255	713.107	400.333	715.683	400.421	718.268	400.521	720.861	400.629	723.464	400.750	726.075	400.879	728.695	401.020	731.323	401.171	400	
400	631.083	360.052	633.618	360.093	636.163	360.144	638.718	360.208	641.282	360.283	643.856	360.370	646.441	360.469	649.035	360.578	651.639	360.700	654.252	360.833	656.876	360.977	659.509	361.134	662.152	361.302	360	
350	613.764	350.053	616.300	350.095	618.846	350.149	621.402	350.214	623.969	350.291	626.545	350.381	629.132	350.482	631.729	350.595	634.336	350.720	636.952	350.857	639.579	351.006	642.216	351.166	644.863	351.339	350	
300	527.169	300.062	529.711	300.111	532.265	300.174	534.830	300.250	537.408	300.340	539.997	300.444	542.598	300.562	545.210	300.694	547.834	300.840	550.470	300.999	553.118	301.173	555.777	301.360	558.448	301.561	300	80 (P)*
250	440.577	250.075	443.127	250.133	445.692	250.208	448.271	250.300	450.863	250.408	453.470	250.533	456.091	250.675	458.726	250.833	461.374	251.008	464.037	251.199	466.713	251.407	469.403	251.632	472.107	251.873	250	
230	405.942	230.041	408.496	230.145	411.066	230.226	413.652	230.326	416.252	230.444	418.868	230.579	421.500	230.733	424.146	230.905	426.807	231.095	429.483	231.303	432.175	231.530	434.881	231.774	437.602	232.036	230	
200	353.991	200.094	356.533	200.167	359.134	200.269	361.732	200.375	364.347	200.510	366.980	200.666	369.631	200.843	372.299	201.041	374.983	201.259	377.686	201.499	380.405	201.759	383.141	202.039	385.893	202.341	200	
170	302.043	170.110	304.617	170.196	307.212	170.306	309.826	170.441	312.462	170.600	315.118	170.784	317.794	170.992	320.491	171.224	323.208	171.481	325.944	171.763	328.700	172.068	331.476	172.398	334.271	172.752	170	65 (P)*
155	276.072	155.121	278.653	155.215	281.256	155.336	283.862	155.484	286.531	155.658	289.201	155.860	291.894	156.088	294.609	156.343	297.346	156.624	300.104	156.933	302.884	157.268	305.686	157.629	308.508	158.018	155	
125	224.133	125.150	226.735	125.266	229.363	125.416	232.018	125.602	234.702	125.816	237.412	126.066	240.150	126.348	242.914	126.664	245.705	127.013	248.523	127.395	251.367	127.810	254.236	128.257	257.131	128.738	125	
100	180.866	100.187	183.490	100.333	186.149	100.520	188.843	100.749	191.570	101.020	194.331	101.337	197.126	101.684	199.953	102.079	202.813	102.514	205.705	102.990	208.629	103.507	211.583	104.065	214.569	104.664	100	
90	163.563	90.208	166.201	90.370	168.877	90.578	171.592	90.832	174.343	91.133	177.132	91.479	179.958	91.871	182.820	92.308	185.717	92.792	188.649	93.320	191.616	93.894	194.617	94.513	197.651	95.176	90	50 (P)*
80	146.285	80.234	148.919	80.416	151.617	80.650	154.357	80.936	157.139	81.274	159.963	81.663	162.826	82.103	165.730	82.595	168.673	83.138	171.655	83.731	174.675	84.375	177.732	85.069	180.826	85.814	80	50 (H)**
70	128.973	70.268	131.649	70.476	134.374	70.743	137.147	71.070	139.967	71.455	142.834	71.899	145.746	72.402	148.703	72.963	151.704	73.581	154.748	74.258	157.834	74.991	160.961	75.781	164.128	76.628	70	
60	111.690	60.312	114.394	60.535	117.156	60.867	119.972	61.247	122.842	61.696	125.766	62.213	128.741	62.794	131.767	63.451	134.843	64.170	137.966	64.956	141.137	65.807	144.352	66.723	147.612	67.704	60	40 (P)*
55	103.053	55.341	105.776	55.605	108.560	55.945	111.403	56.360	114.305	56.849	117.264	57.413	120.279	58.050	123.348	58.760	126.469	59.543	129.642	60.397	132.863	61.322	136.133	62.318	139.449	63.383	55	
50	94.421	50.375	97.166	50.666	99.977	51.039	102.852	51.495	105.792	52.033	108.793	52.651	111.853	53.354	114.972	54.130	118.147	54.988	121.376	55.923	124.657	56.936	127.989	58.025	131.368	59.189	50	40 (H)**
45	85.796	45.416	88.566	45.739	91.410	46.154	94.325	46.660	97.308	47.256	100.359	47.942	103.475	48.717	106.653	49.579	109.891	50.526	113.188	51.562	116.536	52.680	119.935	53.880	123.381	55.162	45	35 (P)*
40	77.179	40.468	79.981	40.831	82.865	41.298	85.828	41.866	88.866	42.535	91.978	43.309	95.159	44.171	98.408	45.136	101.721	46.197	105.094	47.351	108.525	48.597	112.010	49.934	115.546	51.358	40	35 (H) 30 (P)*
35	68.573	35.535	71.417	35.950	74.352	36.481	77.374	37.129	80.480	37.891	83.667	38.763	86.930	39.751	90.265	40.845	93.667	42.046	97.133	43.350	100.658	44.753	104.237	46.259	107.866	47.857	35	
33	65.136	33.567	67.999	34.007	70.958	34.570	74.009	35.256	77.147	36.063	80.369	36.988	83.669	38.030	87.044	39.185	90.487	40.452	93.995	41.827	97.561	43.307	101.181	44.888	104.850	46.567	33	
30	59.986	30.624	62.883	31.107	65.884	31.723	68.983	32.478	72.176	33.362	75.457	34.375	78.821	35.513	82.261	36.775	85.771	38.155	89.346	39.650	92.979	41.256	96.663	42.968	100.392	44.781	30	30 (H)**
25	51.426	25.748	54.396	26.326	57.486	27.065	60.688	27.962	63.994	29.011	67.397	30.213	70.887	31.558	74.455	33.042	78.093	34.659	81.791	36.401	85.540	38.263	89.330	40.236	93.152	42.313	25	
23	48.014	23.812	51.021	24.440	54.156	25.241	57.408	26.212	60.770	27.348	64.231	28.643	67.779	30.091	71.406	31.685	75.099	33.417	78.848	35.279	82.641	37.261	86.467	39.355			23	25 (P)*
20	42.914	20.933	45.989	21.652	49.204	22.568	52.547	23.676	56.005	24.967	59.564	26.434	63.210	28.066	66.928	29.854	70.703	31.786	74.521								20	25 (H)**
15	34.492	16.239	37.129	17.187	41.130	18.387	44.673	19.825	48.332	21.484	52.080	23.345	55.891	25.388													15	20 (P)*
14	32.826	15.326	36.106	16.338	39.555	17.616	43.146	19.143	46.850	20.898	50.635	22.859															14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix 3

TABLE 10 : TABLE FOR TANGENT AND APEX DISTANCES FOR COMBINED TRANSITION AND CIRCULAR CURVE

Deviation Angle = 120 Degrees

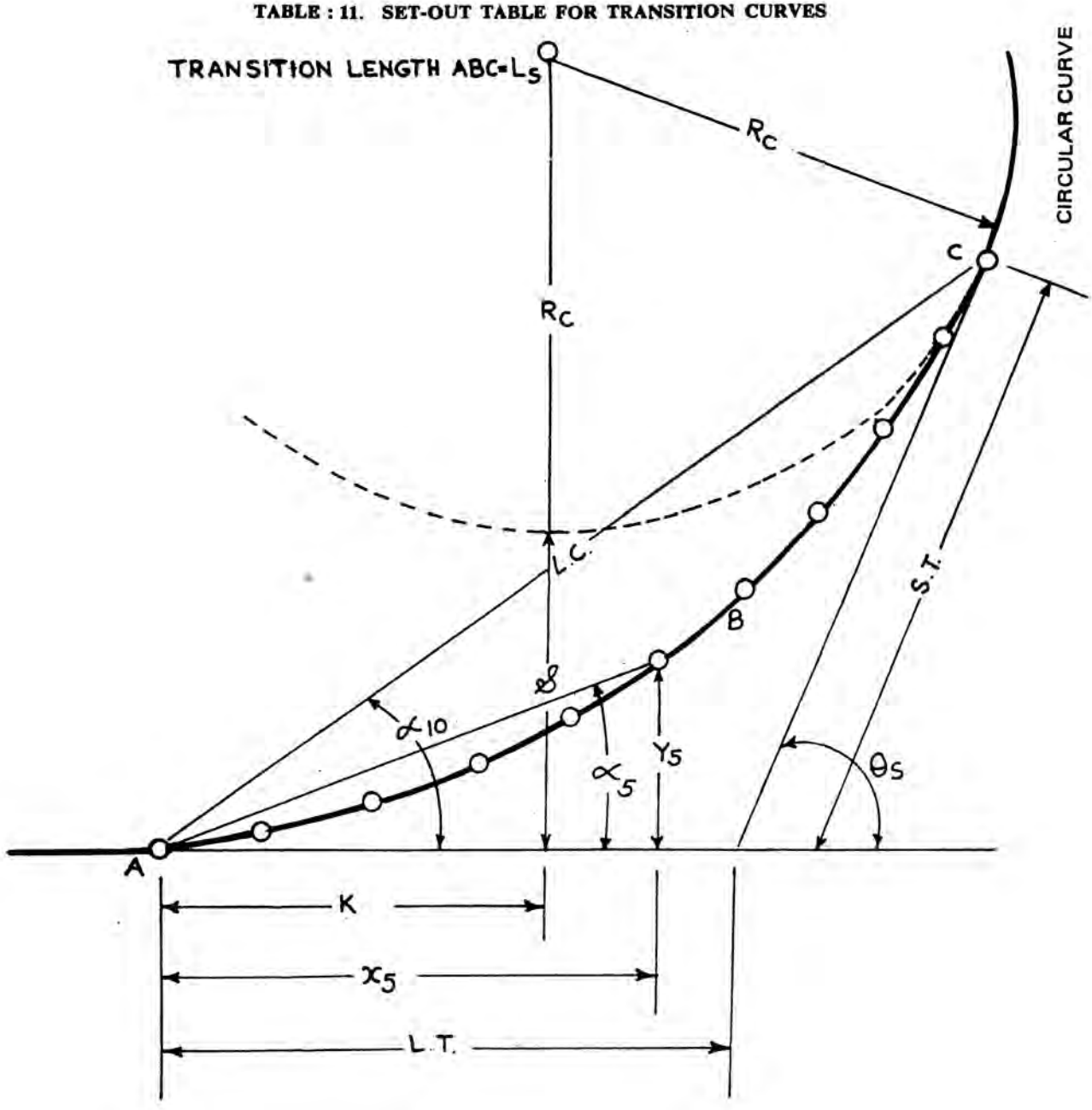
$\Delta = 120°$

R_c	L_s=80 metres		L_s=85 metres		L_s=90 metres		L_s=95 metres		L_s=100 metres		L_s=105 metres		L_s=110 metres		L_s=115 metres		L_s=120 metres		L_s=125 metres		L_s=130 metres		L_s=135 metres		L_s=140 metres		R_c	Speed km/h
metre	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	T_s	E_s	metre	
2500	4370.309	2500.211	4372.032	2500.238	4375.359	2500.270	4377.887	2500.297	4380.414	2500.332	4382.941	2500.367	4385.473	2500.402	4388.008	2500.437	4390.539	2500.477	4393.074	2500.520	4925.613	2500.562	4398.152	2500.605	4400.691	2500.652	2500	
2200	3850.719	2200.238	3853.246	2200.270	3855.775	2200.305	3858.305	2200.340	3860.837	2200.375	3863.370	2200.414	3865.906	2200.457	3868.443	2200.500	3870.981	2200.543	3873.521	2200.590	3876.062	2200.637	3878.606	2200.688	3881.150	2200.738	2200	
2000	3504.330	2000.263	3506.860	2000.299	3509.391	2000.333	3511.925	2000.374	3514.460	2000.415	3516.997	2000.458	3519.535	2000.502	3522.075	2000.549	3524.618	2000.598	3527.162	2000.649	3529.708	2000.702	3532.255	2000.757	3534.804	2000.814	2000	
1800	3157.946	1800.295	3160.479	1800.333	3163.014	1800.373	3165.551	1800.416	3168.090	1800.461	3170.630	1800.509	3173.173	1800.558	3175.718	1800.611	3178.265	1800.665	3180.814	1800.721	3183.365	1800.781	3185.917	1800.842	3188.472	1800.905	1800	
1500	2638.382	1500.354	2640.921	1500.400	2643.464	1500.449	2646.008	1500.500	2648.554	1500.554	2651.103	1500.611	2653.655	1500.671	2656.208	1500.733	2658.764	1500.798	2661.323	1500.867	2663.884	1500.937	2666.447	1501.011	2669.013	1501.087	1500	
1200	2118.843	1200.443	2121.393	1200.501	2123.945	1200.561	2126.500	1200.625	2129.058	1200.693	2131.620	1200.764	2134.184	1200.839	2136.751	1200.917	2139.321	1200.999	2141.894	1201.084	2144.470	1201.172	2147.049	1201.264	2149.631	1201.360	1200	
1000	1772.510	1000.532	1775.069	1000.601	1777.631	1000.674	1780.198	1000.751	1782.768	1000.833	1785.341	1000.917	1787.917	1001.007	1790.498	1001.101	1793.082	1001.199	1795.669	1001.301	1798.260	1001.407	1800.855	1001.518	1803.453	1001.632	1000	
900	1599.356	900.592	1601.921	900.658	1604.491	900.749	1607.064	900.834	1609.642	900.925	1612.223	901.020	1614.808	901.119	1617.397	901.223	1619.990	901.332	1622.587	901.445	1625.188	901.563	1627.793	901.686	1630.402	901.813	900	
800	1426.214	800.666	1428.788	800.752	1431.366	800.843	1433.948	800.939	1436.535	801.041	1439.127	801.148	1441.723	801.260	1444.323	801.377	1446.927	801.499	1449.537	801.627	1452.150	801.759	1454.768	801.897	1457.390	802.040	800	
700	1253.090	700.761	1255.675	700.839	1258.264	700.964	1260.858	701.073	1263.457	701.190	1266.062	701.311	1268.671	701.439	1271.285	701.573	1273.905	701.713	1276.529	701.859	1279.158	702.010	1281.792	702.168	1284.432	702.332	700	
600	1079.994	600.888	1082.592	601.001	1085.196	601.125	1087.805	601.253	1090.421	601.388	1093.042	601.530	1095.670	601.680	1098.303	601.836	1100.942	601.999	1103.586	602.169	1106.236	602.346	1108.893	602.530	1111.554	602.720	600	
500	906.940	501.066	909.557	501.203	912.182	501.349	914.813	501.503	917.451	501.666	920.096	501.836	922.748	502.015	925.407	502.203	928.074	502.398	930.746	502.602	933.426	502.814	936.113	503.035	938.806	503.264	500	
400	733.961	401.333	736.607	401.504	739.261	401.686	741.925	401.879	744.597	402.082	747.278	402.295	749.967	402.519	752.665	402.753	755.371	402.997	758.086	403.252	760.809	403.517	763.541	403.792	766.281	404.079	400	
350	664.804	351.481	667.466	351.671	670.137	351.874	672.819	352.088	675.509	352.313	678.209	352.550	680.919	352.799	683.638	353.058	686.366	353.330	689.104	353.613	691.852	353.907	694.608	354.213	697.374	354.531	350	100 (P)*
300	647.519	351.523	650.186	351.719	652.862	351.927	655.548	352.147	658.244	352.379	660.950	352.623	663.665	352.878	666.390	353.146	669.125	353.425	671.869	353.716	674.623	354.019	677.387	354.333	680.160	354.660	350	
300	561.130	301.777	563.823	302.003	566.528	302.248	569.245	302.505	571.972	302.775	574.711	303.059	577.461	303.357	580.222	303.669	582.994	303.994	585.778	304.333	588.572	304.686	591.377	305.053	594.194	305.434	300	
250	474.824	252.131	477.555	252.406	480.300	252.697	483.057	253.004	485.828	253.328	488.613	253.669	491.411	254.026	494.222	254.400	497.046	254.790	499.883	255.197	502.733	255.620	505.596	256.059	508.477	256.515	250	
230	440.337	232.316	443.087	232.614	445.852	232.931	448.632	233.265	451.423	233.617	454.233	233.987	457.056	234.375	459.892	234.781	462.743	235.205	465.608	235.646	468.487	236.105	471.379	236.583	474.286	237.078	230	80 (P)*
200	388.663	202.663	391.449	203.005	394.252	203.369	397.071	203.753	399.906	204.157	402.758	204.582	405.626	205.028	408.510	205.494	411.410	205.980	414.326	206.488	417.257	207.015	420.204	207.563	423.167	208.131	200	
170	337.086	173.131	339.920	173.534	342.773	173.960	345.646	174.412	348.537	174.887	351.447	175.386	354.375	175.909	357.321	176.456	360.286	177.027	363.269	177.622	366.270	178.241	369.289	178.884	372.325	179.550	170	
135	311.332	158.433	314.217	158.874	317.102	159.342	320.008	159.836	322.934	160.356	325.880	160.903	328.846	161.476	331.833	162.075	334.838	162.700	337.864	163.352	340.908	164.029	343.972	164.732	347.054	165.461	135	65 (P)*
125	280.052	129.251	282.997	129.797	285.968	130.375	288.962	130.986	271.981	131.629	275.024	132.304	278.091	133.011	281.181	133.750	284.294	134.521	287.430	135.324	290.588	136.158	293.769	137.024	296.971	137.921	125	
100	217.585	105.303	220.631	105.982	223.707	106.701	226.811	107.460	229.944	108.259	233.105	109.097	236.294	109.975	239.509	110.891	242.752	111.847	246.020	112.841	249.314	113.873	252.633	114.943	255.977	116.050	100	
90	200.719	95.884	203.818	96.637	206.950	97.433	210.112	98.274	213.305	99.158	216.529	100.085	219.781	101.055	223.062	102.068	226.372	103.124	229.709	104.221	233.073	105.360	236.463	106.540	239.878	107.761	90	50 (P)
80	183.955	86.607	187.120	87.451	190.319	88.343	193.551	89.283	196.816	90.272	200.113	91.309	203.442	92.393	206.801	93.525	210.189	94.702	213.606	95.926	217.051	97.195	220.523	98.509	224.021	99.867	80	30 (H)**
70	167.334	77.531	170.578	78.489	173.859	79.502	177.177	80.569	180.529	81.690	183.915	82.864	187.334	84.091	190.785	85.370	194.266	86.700	197.777	88.080	201.316	89.511	204.882	90.990	208.475	92.517	70	
60	150.913	68.749	154.258	69.857	157.642	71.027	161.063	72.258	164.522	73.549	168.016	74.900	171.543	76.310	175.102	77.777	178.692	79.301	182.312	80.879	185.958	82.512	189.630	84.199	193.326	85.936	60	40 (P)*
55	141.809	64.516	146.211	65.716	149.655	66.983	153.183	68.316	156.658	69.712	160.213	71.171	163.801	72.692	167.422	74.274	171.072	75.914	174.749	77.612	178.453	79.366	182.180	81.175	185.929	83.037	55	
50	134.791	60.426	138.263	61.736	141.773	63.116	145.323	64.566	148.910	66.084	152.532	67.668	156.186	69.317	159.871	71.029	163.583	72.803	167.320	74.636	171.080	76.526	174.861	78.472	178.660	80.473	50	40 (H)**
45	126.891	56.323	130.434	57.961	134.019	59.675	137.643	61.063	141.302	62.723	144.995	64.452	148.717	66.249	152.466	68.111	156.239	70.036	160.033	72.021	163.845	74.065	167.673	76.164	171.513	78.315	45	35 (P)*
40	119.424	52.867	122.754	54.459	126.420	56.132	130.122	57.883	133.856	59.708	137.619	61.606	141.407	63.573	145.216	65.605	149.043	67.701	152.883	69.856							40	30 (H)**
35	111.540	49.547	115.254	51.324	119.003	53.186	122.782	75.128	126.587	57.147	130.412	59.238															35	
33	108.561	48.339	112.310	50.201	116.091	52.148	119.899	54.176	123.727	56.280																	33	30 (P)*
30	104.159	46.691	107.958	48.691	111.782	50.776																					30	30 (H)**
25																											25	
23																											23	25 (P)*
20																											20	25 (H)**
15																											15	20 (P)*
14																											14	20 (H)**

*P = Plain & Rolling Terrain **H = Mountainous & Steep Terrain

Appendix–4

TABLE : 11. SET-OUT TABLE FOR TRANSITION CURVES



Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_O	Length of Transition Curve to Chord Points in Metre										L.T.	S.T	L.C.	Θ_B	s	K	R_O
	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 2	0 0 8	0 0 18	0 0 33	0 0 51	0 1 14	0 1 41	0 2 12	0 2 47	0 3 26	10.000	5.000	15.000	0 10 18	0.004	7.500	**2500**
2200	0 0 2	0 0 9	0 0 21	0 0 37	0 0 58	0 1 24	0 1 54	0 2 30	0 3 9	0 3 54	10.000	5.000	15.000	0 11 43	0.004	7.500	**2200**
2000	0 0 2	0 0 10	0 0 23	0 0 41	0 1 4	0 1 32	0 2 6	0 2 45	0 3 28	0 4 17	10.000	5.000	15.000	0 12 53	0.005	7.500	**2000**
1800	0 0 2	0 0 11	0 0 25	0 0 45	0 1 11	0 1 43	0 2 20	0 3 3	0 3 52	0 4 46	10.000	5.000	15.000	0 14 19	0.005	7.500	**1800**
1500	0 0 3	0 0 13	0 0 30	0 0 55	0 1 25	0 2 3	0 2 48	0 3 40	0 4 38	0 5 43	10.000	5.000	15.000	0 17 11	0.009	7.500	**1500**
1200	0 0 4	0 0 17	0 0 38	0 1 8	0 1 47	0 2 34	0 3 30	0 4 35	0 5 48	0 7 9	10.000	5.000	15.000	0 21 29	0.008	7.500	**1200**
1000	0 0 5	0 0 20	0 0 46	0 1 22	0 2 8	0 3 5	0 4 12	0 5 30	0 6 57	0 8 35	10.000	5.000	15.000	0 25 46	0.009	7.500	**1000**
900	0 0 5	0 0 22	0 0 51	0 1 31	0 2 23	0 3 26	0 4 40	0 6 6	0 7 44	0 9 32	10.000	5.000	15.000	0 28 38	0.010	7.500	**900**
800	0 0 6	0 0 25	0 0 58	0 1 43	0 2 41	0 3 52	0 5 15	0 6 52	0 8 42	0 10 44	10.000	5.000	15.000	0 32 13	0.012	7.500	**800**
700	0 0 7	0 0 29	0 1 6	0 1 57	0 3 4	0 4 25	0 6 0	0 7 51	0 9 56	0 12 16	10.000	5.000	15.000	0 36 49	0.013	7.500	**700**
600	0 0 8	0 0 34	0 1 17	0 2 17	0 3 34	0 5 9	0 7 1	0 9 10	0 11 36	0 14 19	10.000	5.000	15.000	0 42 58	0 016	7.500	**600**
500	0 0 10	0 0 41	0 1 32	0 2 45	0 4 17	0 6 11	0 8 25	0 11 0	0 13 55	0 17 11	10.000	5.000	15.000	0 51 33	0.019	7.500	**500**
400	0 0 12	0 0 51	0 1 56	0 3 26	0 5 22	0 7 44	0 10 31	0 13 45	0 17 24	0 21 29	10.000	5.000	15.000	1 4 27	0.023	7.500	**400**
360	0 0 14	0 0 57	0 2 8	0 3 49	0 5 58	0 8 35	0 11 41	0 15 16	0 19 20	0 23 52	10.000	5.000	15.000	1 11 37	0.026	7.500	**360**
350	0 0 14	0 0 58	0 2 12	0 3 55	0 6 8	0 8 50	0 12 1	0 15 42	0 19 53	0 24 33	10.000	5.000	15.000	1 13 39	0.027	7.500	**350**
300	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	10.000	5.000	15.000	1 25 56	0.031	7.500	**300**
250	0 0 20	0 1 22	0 3 5	0 5 30	0 8 35	0 12 22	0 16 50	0 22 0	0 27 50	0 34 22	10.000	5.000	14.999	1 43 7	0.037	7.500	**250**
230	0 0 22	0 1 29	0 3 21	0 5 58	0 9 20	0 13 27	0 18 18	0 23 54	0 30 16	0 37 21	10.001	5.001	14.999	1 52 6	0.041	7.500	**230**
200	0 0 25	0 1 43	0 3 52	0 6 52	0 10 44	0 15 28	0 21 3	0 27 30	0 34 48	0 42 58	10.001	5.001	14.999	2 8 54	0.047	7.500	**200**
170	0 0 30	0 2 1	0 4 32	0 8 5	0 12 38	0 18 11	0 24 46	0 32 21	0 40 56	0 50 33	10.001	5.001	14.999	2 31 39	0.055	7.500	**170**
155	0 0 33	0 2 13	0 4 59	0 8 52	0 13 51	0 19 57	0 27 10	0 35 29	0 44 54	0 55 26	10.001	5.001	14.998	2 46 20	0.060	7.499	**155**
125	0 0 41	0 2 45	0 6 11	0 11 0	0 17 11	0 24 45	0 33 41	0 44 0	0 55 41	1 8 45	10.002	5.002	14.998	3 26 15	0.075	7.499	**125**
100	0 0 51	0 3 26	0 7 44	0 13 45	0 21 29	0 30 56	0 42 6	0 55 0	1 9 36	1 25 56	10.003	5.003	14.996	4 17 49	0.094	7.499	**100**
90	0 0 57	0 3 49	0 8 35	0 15 16	0 23 52	0 34 22	0 46 47	1 1 6	1 17 20	1 35 29	10.004	5.003	14.995	4 46 28	0.104	7.498	**90**
80	0 1 4	0 4 17	0 9 40	0 17 11	0 26 51	0 38 40	0 52 38	1 8 45	1 27 0	1 47 25	10.005	5.004	14.994	5 22 17	0.117	7.498	**80**
70	0 1 13	0 4 54	0 11 2	0 19 38	0 30 41	0 44 11	1 0 9	1 18 34	1 39 26	2 2 45	10.006	5.005	14.992	6 8 19	0.134	7.497	**70**
60	0 1 25	0 5 43	0 12 53	0 22 55	0 35 48	0 51 33	1 10 11	1 31 40	1 56 0	2 23 13	10.008	5.007	14.990	7 9 43	0.156	7.496	**60**
55	0 1 33	0 6 15	0 14 3	0 25 0	0 39 3	0 56 15	1 16 33	1 40 0	2 6 33	2 36 14	10.010	5.009	14.988	7 48 47	0.170	7.495	**55**
50	0 1 43	0 6 52	0 15 28	0 27 30	0 42 58	1 1 52	1 24 13	1 49 59	2 19 12	2 51 51	10.012	5.011	14.985	8 35 39	0.187	7.494	**50**
45	0 1 54	0 7 38	0 17 11	0 30 33	0 47 44	1 8 45	1 33 34	2 2 13	2 34 40	3 10 56	10.015	5.013	14.981	9 32 57	0.208	7.493	**45**
40	0 2 8	0 8 35	0 19 20	0 34 22	0 53 42	1 17 20	1 45 16	2 17 29	2 54 0	3 34 47	10.018	5.017	14.976	10 44 34	0.234	7.491	**40**
35	0 2 27	0 9 49	0 22 5	0 39 17	1 1 23	1 28 23	2 0 18	2 37 7	3 18 50	4 5 27	10.024	5.022	14.969	12 16 39	0.267	7.488	**35**
33	0 2 36	0 10 25	0 23 26	0 41 40	1 5 6	1 33 45	2 7 36	2 46 38	3 30 53	4 20 19	10.027	5.025	14.965	13 1 18	0.284	7.487	**33**
30	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	10.033	5.030	14.958	14 19 26	0.312	7.484	**30**
25	0 3 26	0 13 45	0 30 56	0 55 0	1 25 56	2 3 44	2 48 25	3 39 56	4 38 19	5 43 30	10.047	5.043	14.940	17 11 19	0.374	7.477	**25**
23	0 3 44	0 14 56	0 33 37	0 59 47	1 33 24	2 14 30	3 3 3	3 59 3	5 2 29	6 13 19	10.055	5.051	14.928	18 41 0	0.406	7.473	**23**
20	0 4 17	0 17 11	0 38 40	1 8 45	1 47 25	2 34 40	3 30 30	4 34 53	5 47 47	7 9 12	10.073	5.068	14.905	21 29 9	0.466	7.464	**20**
15	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	10.130	5.122	14.830	28 38 52	0.619	7.434	**15**
14	0 6 8	0 24 33	0 55 14	1 38 12	2 33 26	3 40 55	5 0 37	6 32 29	8 16 26	10 12 22	10.149	5.141	14.804	30 41 39	0.663	7.423	**14**

Ls=15 metre

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=15 metre

R_C metre	Length of Transition Curve to Chord Points in Metre										R_C metre
	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0	
	X 1 Y 1	X 2 Y2	X 3 Y 3	X 4 Y 4	X 5 Y 5	X 6 Y 6	X 7 Y 7	X 8 Y 8	X 9 Y 9	X 10 Y 10	
2500	1.500 0.000	3.000 0.000	4.500 0.000	6.000 0.001	7.500 0.002	9.000 0.003	10 500 0.005	12.000 0.008	13.500 0.011	15.000 0.015	2500
2200	1.500 0.000	3.000 0.000	4.500 0.000	6.000 0.001	7.500 0.002	9.000 0.004	10.500 0.006	12.000 0.009	13.500 0.012	15.000 0.017	2200
2000	1.500 0.000	3.000 0.000	4.500 0.001	6.000 0.001	7.500 0.002	9.000 0.004	10.500 0.005	12.000 0.010	13.500 0.014	15.000 0.019	2000
1800	1.500 0.000	3.000 0.000	4.500 0.001	6.000 0.001	7.500 0.003	9.000 0.005	10.500 0.007	12.000 0.011	13.500 0.015	15.000 0.021	1800
1500	1.500 0.000	3.000 0.000	4.500 0.001	6.000 0.002	7.500 0.003	9.000 0.005	10.500 0.009	12.000 0.013	13.500 0.018	15.000 0.025	1500
1200	1.500 0.000	3.000 0.000	4.500 0.001	6.000 0.002	7.500 0.004	9.000 0.007	10.500 0.011	12.000 0.016	13.500 0.023	15.000 0.031	1200
1000	1.500 0.000	3.000 0.000	4.500 0.001	6.000 0.002	7.500 0.005	9.000 0.008	10.500 0.013	12.000 0.019	13.500 0.027	15.000 0.037	1000
900	1.500 0.000	3.000 0.000	4.500 0.001	6.000 0.003	7.500 0.005	9.000 0.009	10.500 0.014	12.000 0.021	13.500 0.030	15.000 0.042	900
800	1.500 0.000	3.000 0.000	4.500 0.001	6.000 0.003	7.500 0.006	9.000 0.010	10.500 0.016	12.000 0.024	13.500 0.034	15.000 0.047	800
700	1.500 0.000	3.000 0.000	4.500 0.001	6.000 0.003	7.500 0.007	9.000 0.012	10.500 0.018	12.000 0.027	13.500 0.039	15.000 0.054	700
600	1.500 0.000	3.000 0.001	4.500 0.002	6.000 0.004	7.500 0.008	9.000 0.013	10.500 0.021	12.000 0.032	13.500 0.046	15.000 0.062	600
500	1.500 0.000	3.000 0.001	4.500 0.002	6.000 0.005	7.500 0.009	9.000 0.016	10.500 0.026	12.000 0.038	13.500 0.055	15.000 0.075	500
400	1.500 0.000	3.000 0.001	4.500 0.003	6.000 0.006	7.500 0.012	9.000 0.020	10.500 0.032	12.000 0.048	13.500 0.068	14.999 0.094	400
360	1.500 0.000	3.000 0.001	4.500 0.003	6.000 0.007	7.500 0.013	9.000 0.022	10.500 0.036	12.000 0.053	13.500 0.076	14.999 0.104	360
350	1.500 0.000	3.000 0.001	4.500 0.003	6.000 0.007	7.500 0.013	9.000 0.023	10.500 0.037	12.000 0.055	13.500 0.078	14.999 0.107	350
300	1.500 0.000	3.000 0.001	4.500 0.003	6.000 0.008	7.500 0.016	9.000 0.027	10.500 0.043	12.000 0 064	13.499 0.091	14.999 0.125	300
250	1.500 0.000	3.000 0.001	4.500 0.004	6.000 0.010	7.500 0.019	9.000 0.032	10.500 0.051	12.000 0 077	13.499 0.109	14.999 0.150	250
230	1.500 0.000	3.000 0.001	4.500 0.004	6.000 0.010	7.500 0.020	9.000 0.035	10.500 0.056	11.999 0 083	13.499 0.119	14.998 0.163	230
200	1.500 0.000	3.000 0.001	4.500 0.005	6.000 0.012	7.500 0.023	9.000 0.040	10.500 0.064	11.999 0.096	13.499 0.137	14.998 0.187	200
170	1.500 0.000	3.000 0.002	4.500 0.006	6.000 0.014	7.500 0.028	9.000 0.048	10.500 0.076	11.999 0.113	13.498 0.161	14.997 0.221	170
155	1.500 0.000	3.000 0.002	4.500 0 007	6.000 0.015	7.500 0.030	9.000 0.052	10.499 0.083	11.999 0.124	13.498 0.176	14.996 0.242	155
125	1.500 0.000	3.000 0.002	4.500 0.008	6.000 0.019	7.500 0.037	9.000 0.065	10.499 0.103	11.998 0.154	13.497 0.219	14.995 0 300	125
100	1.500 0.000	3.000 0.003	4.500 0.010	6.000 0.024	7.500 0.047	8.999 0 081	10.499 0.129	11.997 0 192	13.495 0.273	14.992 0.375	100
90	1.500 0.000	3.000 0.003	4.500 0.011	6.000 0.027	7.500 0.052	8.999 0.090	10.498 0.143	11.997 0.213	13.494 0.304	14.990 0.416	90
80	1.500 0.000	3.000 0.004	4.500 0.013	6.000 0.030	7.500 0.059	8.999 0.101	10.498 0.161	11.996 0.240	13.492 0.342	14.987 0.468	80
70	1.500 0.001	3.000 0.004	4.500 0.014	6.000 0.034	7.499 0.067	8.999 0.116	10 497 0.184	11.994 0 274	13 490 0.390	14.983 0.535	70
60	1.500 0.001	3.000 0.005	4.500 0.017	6.000 0.040	7.499 0.078	8.998 0.135	10.496 0.214	11.992 0.320	13.486 0.455	14.977 0.624	60
55	1.500 0.001	3.000 0.005	4.500 0.018	6.000 0.044	7.499 0.085	8.998 0.147	10.495 0.234	11.991 0.349	13.484 0.497	14.972 0.681	55
50	1.500 0.001	3.000 0.006	4.500 0.020	6.000 0.048	7.499 0.094	8.997 0.162	10.494 0.257	11.989 0.384	13.480 0.546	14.966 0.749	50
45	1.500 0.001	3.000 0.007	4.500 0.022	6.000 0.053	7.499 0.104	8.997 0.180	10.493 0.286	11.986 0.426	13.475 0.607	14.958 0.832	45
40	1.500 0.001	3.000 0.007	4.500 0.025	5.999 0 060	7.498 0.117	8.996 0.202	10.491 0.321	11.983 0.480	13.469 0.682	14.947 0.935	40
35	1.500 0.001	3.000 0.009	4.500 0.029	5.999 0.069	7.498 0.134	8.995 0.231	10.488 0.367	11.977 0.548	13.459 0.779	14.931 1.068	35
33	1.500 0.001	3.000 0.009	4.500 0.031	5.999 0.073	7.498 0.142	8.994 0.245	10.487 0.389	11.975 0 581	13.454 0.826	14.923 1.132	33
30	1.500 0.001	3.000 0.010	4.500 0.034	5.999 0.080	7.497 0.156	8.993 0.270	10.484 0.428	11.969 0.639	13.445 0.909	14.907 1.244	30
25	1.500 0.001	3.000 0.012	4.500 0.040	5.999 0.096	7.496 0.187	8.990 0.324	10.477 0.514	11.956 0.766	13.421 1.089	14.866 1.490	25
23	1.500 0.002	3.000 0.013	4.500 0.044	5.998 0.104	7.495 0.204	8.988 0.352	10.473 0.558	11.948 0.832	13.406 1.183	14.841 1.618	23
20	1.500 0.002	3.000 0.015	4.499 0.051	5.998 0.120	7.493 0.234	8.984 0.404	10.465 0.642	11.931 0.956	13.376 1.358	14.790 1.856	20
15	1.500 0.002	3.000 0.020	4.499 0.067	5.996 0.160	7.488 0.312	8.971 0.539	10.437 0.854	11.878 1.271	13.280 1.801	14.629 2.456	15
14	1.500 0.003	3.000 0.021	4.499 0.072	5.996 0.171	7.487 0.334	8.967 0.577	10.428 0.914	11.860 1.360	13.248 1.927	14.575 2.624	14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_O	Length of Transition Curve to Chord Points in Metre										L.T.	S.T.	L.C.	Θ_s	s	K	R_O
	2.0	4.0	6.0	8.0	10.0	12.0	14.0	16.0	18.0	20.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha.8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 2	0 0 11	0 0 24	0 0 44	0 1 8	0 1 39	0 2 14	0 2 56	0 3 42	0 4 35	13.333	6.667	20.000	0 13 45	0.007	10.000	**2500**
2200	0 0 3	0 0 12	0 0 28	0 0 50	0 1 18	0 1 52	0 2 33	0 3 20	0 4 13	0 5 12	13.333	6.667	20.000	0 15 37	0.007	10.000	**2200**
2000	0 0 3	0 0 13	0 0 30	0 0 55	0 1 25	0 2 3	0 2 48	0 3 40	0 4 38	0 5 43	13.333	6.667	20.000	0 17 11	0.008	10.000	**2000**
1800	0 0 3	0 0 15	0 0 34	0 1 1	0 1 35	0 2 17	0 3 7	0 4 4	0 5 9	0 6 21	13.333	6.667	20.000	0 19 5	0.009	10.000	**1800**
1500	0 0 4	0 0 18	0 0 41	0 1 13	0 1 54	0 2 45	0 3 44	0 4 53	0 6 11	0 7 38	13.333	6.667	20.000	0 22 55	0.011	10.000	**1500**
1200	0 0 5	0 0 22	0 0 51	0 1 31	0 2 23	0 3 26	0 4 40	0 6 6	0 7 44	0 9 32	13.333	6.667	20.000	0 28 38	0.014	10.000	**1200**
1000	0 0 6	0 0 27	0 1 1	0 1 50	0 2 51	0 4 7	0 5 36	0 7 20	0 9 16	0 11 27	13.333	6.667	20.000	0 34 22	0.017	10.000	**1000**
900	0 0 7	0 0 30	0 1 8	0 2 2	0 3 10	0 4 35	0 6 14	0 8 8	0 10 18	0 12 43	13.333	6.667	20.000	0 38 11	0.018	10.000	**900**
800	0 0 8	0 0 34	0 1 17	0 2 17	0 3 34	0 5 9	0 7 1	0 9 10	0 11 36	0 14 19	13.333	6.667	20.000	0 42 58	0.021	10.000	**800**
700	0 0 9	0 0 39	0 1 28	0 2 37	0 4 5	0 5 53	0 8 1	0 10 28	0 13 15	0 16 22	13.333	6.667	20.000	0 49 6	0.024	10.000	**700**
600	0 0 11	0 0 45	0 1 43	0 3 3	0 4 46	0 6 52	0 9 21	0 12 13	0 15 28	0 19 5	13.334	6.667	20.000	0 57 17	0.028	10.000	**600**
500	0 0 13	0 0 55	0 2 3	0 3 40	0 5 43	0 8 15	0 11 13	0 14 40	0 18 33	0 22 55	13.334	6.667	20.000	1 0 45	0.033	10.000	**500**
400	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	13.334	6.667	19.999	1 25 56	0.042	10.000	**400**
360	0 0 19	0 1 16	0 2 51	0 5 5	0 7 57	0 11 27	0 15 35	0 20 22	0 25 46	0 31 49	13.334	6.667	19.999	1 35 29	0.046	10.000	**360**
350	0 0 19	0 1 18	0 2 56	0 5 14	0 8 11	0 11 47	0 16 2	0 20 57	0 26 31	0 32 44	13.334	6.667	19.999	1 38 13	0.048	10.000	**350**
300	0 0 22	0 1 31	0 3 26	0 6 6	0 9 32	0 13 45	0 18 42	0 24 26	0 30 56	0 38 11	13.334	6.667	19.999	1 54 35	0.056	10.000	**300**
250	0 0 27	0 1 50	0 4 7	0 7 20	0 11 27	0 16 30	0 22 27	0 29 20	0 37 7	0 45 50	13.334	6.668	19.999	2 17 30	0.067	9.999	**250**
230	0 0 29	0 1 59	0 4 29	0 7 58	0 12 27	0 17 56	0 24 24	0 31 53	0 40 21	0 49 49	13.335	6.668	19.998	2 29 28	0.072	9.999	**230**
200	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17	13.335	6.668	19.998	2 51 53	0.083	9.999	**200**
170	0 0 40	0 2 41	0 6 3	0 10 47	0 16 51	0 24 15	0 33 1	0 43 8	0 54 35	1 7 24	13.336	6.669	19.997	3 22 13	0.098	9.999	**170**
155	0 0 44	0 2 57	0 6 39	0 11 49	0 18 28	0 26 36	0 36 13	0 47 18	0 59 52	1 13 55	13.336	6.669	19.996	3 41 47	0.108	9.999	**155**
125	0 0 55	0 3 40	0 8 15	0 14 40	0 22 35	0 33 0	0 44 55	0 58 40	1 14 15	1 31 40	13.338	6.671	19.994	4 35 1	0.133	9.998	**125**
100	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34	13.340	6.673	19.991	5 43 46	0.167	9.997	**100**
90	0 1 16	0 5 5	0 11 27	0 20 22	0 31 49	0 45 50	1 2 23	1 21 29	1 43 7	2 7 18	13.342	6.675	19.989	6 21 58	0.185	9.996	**90**
80	0 1 25	0 5 43	0 12 53	0 22 55	0 35 48	0 51 33	1 10 11	1 31 40	1 56 0	2 23 13	13.344	6.677	19.986	7 9 43	0.208	9.995	**80**
70	0 1 38	0 6 32	0 14 43	0 26 11	0 40 55	0 58 55	1 20 12	1 44 45	2 12 35	2 43 40	13.348	6.680	19.982	8 11 6	0.238	9.993	**70**
60	0 1 54	0 7 38	0 17 11	0 30 33	0 47 44	1 8 45	1 33 34	2 2 13	2 34 40	3 10 56	13.353	6.684	19.975	9 32 57	0.278	9.991	**60**
55	0 2 5	0 8 20	0 18 45	0 33 20	0 52 5	1 15 0	1 42 5	2 13 19	2 48 43	3 28 17	13.356	6.688	19.971	10 25 2	0.303	9.989	**55**
50	0 2 17	0 9 10	0 20 37	0 36 40	0 57 17	1 22 30	1 52 17	2 26 39	3 5 35	3 49 6	13.361	6.692	19.964	11 27 32	0.333	9.987	**50**
45	0 2 32	0 10 11	0 22 55	0 40 44	1 3 39	1 31 40	2 4 45	2 42 56	3 26 12	4 14 32	13.368	6.698	19.956	12 43 56	0.370	9.983	**45**
40	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	13.377	6.707	19.944	14 19 26	0.416	9.979	**40**
35	0 3 16	0 13 5	0 29 27	0 52 23	1 21 50	1 57 51	2 40 24	3 29 28	4 25 4	5 27 10	13.390	6.719	19.927	16 22 12	0.475	9.972	**35**
33	0 3 28	0 13 53	0 31 15	0 55 33	1 26 48	2 4 59	2 50 7	3 42 10	4 41 7	5 46 58	13.397	6.726	19.918	17 21 44	0.503	9.969	**33**
30	0 3 49	0 15 16	0 34 22	1 1 6	1 35 29	2 17 29	3 7 7	4 4 22	5 9 12	6 21 36	13.411	6.738	19.900	19 5 54	0.553	9.962	**30**
25	0 4 35	0 18 20	0 41 15	1 13 20	1 54 34	2 44 58	3 44 31	4 53 11	6 10 56	7 37 44	13.444	6.770	19.856	22 55 6	0.663	9.945	**25**
23	0 4 58	0 19 55	0 44 50	1 19 42	2 4 32	2 59 19	4 4 2	5 18 39	6 43 8	8 17 25	13.465	6.789	19.829	24 54 40	0.720	9.934	**23**
20	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	13.506	6.830	19.773	28 38 52	0.826	9.911	**20**
15	0 7 38	0 30 33	1 8 45	2 2 13	3 10 56	4 34 53	6 13 59	8 8 10	10 17 15	12 41 2	13.639	6.962	19.590	38 11 49	1.094	9.836	**15**
14	0 8 11	0 32 44	1 13 39	2 10 56	3 24 34	4 54 29	6 40 39	8 42 54	11 1 6	13 34 55	13.684	7.009	19.527	40 55 32	1.169	9.808	**14**

L_S=20 metre

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 20 metre

R_C	Length of Transition Curve to Chord Points in Metre																		R_C		
	2.0		4.0		6.0		8.0		10.0		12.0		14.0		16.0		18.0		20.0		
metre	X 1	Y 1	X 2	Y 2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	2.000	0.000	4.000	0.000	6.000	0.001	8.000	0.002	10.000	0.003	12.000	0.006	14.000	0.009	16.000	0.014	18.000	0.019	20.000	0.027	**2500**
2200	2.000	0.000	4.000	0.000	6.000	0.001	8.000	0.002	10.000	0.004	12.000	0.007	14.000	0.010	16.000	0.016	18.000	0.022	20.000	0.030	**2200**
2000	2.000	0.000	4.000	0.000	6.000	0.001	8.000	0.002	10.000	0.004	12.000	0.007	14.000	0.011	16.000	0.017	18.000	0.024	20.000	0.033	**2000**
1800	2.000	0.000	4.000	0.000	6.000	0.001	8.000	0.002	10.000	0.005	12.000	0.008	14.000	0.013	16.000	0.019	18.000	0.027	20.000	0.037	**1800**
1500	2.000	0.000	4.000	0.000	6.000	0.001	8.000	0.003	10.000	0.006	12.000	0.010	14.000	0.015	16.000	0.023	18.000	0.032	20.000	0.044	**1500**
1200	2.000	0.000	4.000	0.000	6.000	0.002	8.000	0.004	10.000	0.007	12.000	0.012	14.000	0.019	16.000	0.028	18.000	0.040	20.000	0.056	**1200**
1000	2.000	0.000	4.000	0.001	6.000	0.002	8.000	0.004	10.000	0.008	12.000	0.014	14.000	0.023	16.000	0.034	18.000	0.049	20.000	0.067	**1000**
900	2.000	0.000	4.000	0.001	6.000	0.002	8.000	0.005	10.000	0.009	12.000	0.016	14.000	0.025	16.000	0.038	18.000	0.054	20.000	0.074	**900**
800	2.000	0.000	4.000	0.001	6.000	0.002	8.000	0.005	10.000	0.010	12.000	0.018	14.000	0.029	16.000	0.043	18.000	0.061	20.000	0.083	**800**
700	2.000	0.000	4.000	0.001	6.000	0.003	8.000	0.006	10.000	0.012	12.000	0.021	14.000	0.033	16.000	0.049	18.000	0.069	20.000	0.095	**700**
600	2.000	0.000	4.000	0.001	6.000	0.003	8.000	0.007	10.000	0.014	12.000	0.024	14.000	0.038	16.000	0.057	18.000	0.081	19.999	0.111	**600**
500	2.000	0.000	4.000	0.001	6.000	0.004	8.000	0.009	10.000	0.017	12.000	0.029	14.000	0.046	16.000	0.068	18.000	0.097	19.999	0.133	**500**
400	2.000	0.000	4.000	0.001	6.000	0.005	8.000	0.011	10.000	0.021	12.000	0.036	14.000	0.057	16.000	0.085	17.999	0.121	19.999	0.167	**400**
360	2.000	0.000	4.000	0.001	6.000	0.005	8.000	0.012	10.000	0.023	12.000	0.040	14.000	0.064	15.999	0.095	17.999	0.135	19.998	0.185	**360**
350	2.000	0.000	4.000	0.002	6.000	0.005	8.000	0.012	10.000	0.024	12.000	0.041	14.000	0.065	15.999	0.098	17.999	0.139	19.998	0.190	**350**
300	2.000	0.000	4.000	0.002	6.000	0.006	8.000	0.014	10.000	0.028	12.000	0.048	14.000	0.075	15.999	0.114	17.999	0.162	19.998	0.222	**300**
250	2.000	0.000	4.000	0.002	6.000	0.007	8.000	0.017	10.000	0.033	12.000	0.058	13.999	0.091	15.999	0.137	17.998	0.194	19.997	0.267	**250**
230	2.000	0.000	4.000	0.002	6.000	0.008	8.000	0.019	10.000	0.036	12.000	0.063	13.999	0.099	15.999	0.148	17.998	0.211	19.996	0.290	**230**
200	2.000	0.000	4.000	0.003	6.000	0.009	8.000	0.021	10.000	0.042	12.000	0.072	13.999	0.114	15.998	0.171	17.997	0.243	19.995	0.333	**200**
170	2.000	0.000	4.000	0.003	6.000	0.011	8.000	0.025	10.000	0.049	11.999	0.085	13.999	0.135	15.998	0.201	17.996	0.286	19.993	0.392	**170**
155	2.000	0.000	4.000	0.003	6.000	0.012	8.000	0.028	10.000	0.054	11.999	0.093	13.999	0.148	15.997	0.220	17.995	0.313	19.992	0.430	**155**
125	2.000	0.001	4.000	0.004	6.000	0.014	8.000	0.034	10.000	0.067	11.999	0.115	13.998	0.183	15.996	0.273	17.992	0.389	19.987	0.533	**125**
100	2.000	0.001	4.000	0.005	6.000	0.018	8.000	0.043	9.999	0.083	11.998	0.144	13.997	0.229	15.993	0.341	17.988	0.486	19.980	0.666	**100**
90	2.000	0.001	4.000	0.006	6.000	0.020	8.000	0.047	9.999	0.093	11.998	0.160	13.996	0.254	15.992	0.379	17.985	0.540	19.975	0.740	**90**
80	2.000	0.001	4.000	0.007	6.000	0.022	8.000	0.053	9.999	0.104	11.998	0.180	13.995	0.286	15.990	0.426	17.982	0.607	19.969	0.832	**80**
70	2.000	0.001	4.000	0.008	6.000	0.026	8.000	0.061	9.999	0.119	11.997	0.206	13.993	0.327	15.987	0.487	17.976	0.694	19.959	0.951	**70**
60	2.000	0.001	4.000	0.009	6.000	0.030	7.999	0.071	9.998	0.139	11.996	0.240	13.991	0.381	15.982	0.568	17.967	0.809	19.945	1.109	**60**
55	2.000	0.001	4.000	0.010	6.000	0.033	7.999	0.078	9.998	0.151	11.995	0.262	13.989	0.416	15.978	0.620	17.961	0.882	19.934	1.209	**55**
50	2.000	0.001	4.000	0.011	6.000	0.036	7.999	0.085	9.998	0.167	11.994	0.288	13.987	0.457	15.974	0.682	17.953	0.970	19.920	1.330	**50**
45	2.000	0.001	4.000	0.012	6.000	0.040	7.999	0.095	9.997	0.185	11.992	0.320	13.983	0.508	15.968	0.757	17.942	1.078	19.901	1.476	**45**
40	2.000	0.002	4.000	0.013	6.000	0.045	7.999	0.107	9.996	0.208	11.990	0.360	13.979	0.571	15.959	0.852	17.926	1.211	19.875	1.659	**40**
35	2.000	0.002	4.000	0.015	6.000	0.051	7.998	0.122	9.695	0.238	11.987	0.411	13.973	0.652	15.947	0.973	17.904	1.383	19.837	1.894	**35**
33	2.000	0.002	4.000	0.016	6.000	0.055	7.998	0.129	9.994	0.252	11.986	0.436	13.969	0.692	15.940	1.032	17.892	1.466	19.817	2.007	**33**
30	2.000	0.002	4.000	0.018	5.999	0.060	7.998	0.142	9.993	0.278	11.983	0.480	13.963	0.761	15.927	1.134	17.869	1.612	19.779	2.205	**30**
25	2.000	0.003	4.000	0.021	5.999	0.072	7.997	0.171	9.990	0.333	11.975	0.575	13.946	0.912	15.895	1.359	17.812	1.929	19.682	2.636	**25**
23	2.000	0.003	4.000	0.023	5.999	0.078	7.996	0.185	9.988	0.362	11.971	0.625	13.937	0.991	15.877	1.476	17.778	2.094	19.625	2.860	**23**
20	2.000	0.003	4.000	0.027	5.999	0.090	7.995	0.213	9.984	0.416	11.961	0.718	13.916	1.138	15.837	1.694	17.707	2.402	19.506	2.274	**20**
15	2.000	0.004	4.000	0.036	5.998	0.120	7.991	0.284	9.972	0.554	11.931	0.956	13.851	1.513	15.711	2.246	17.482	3.173	19.129	4.305	**15**
14	2.000	0.005	4.000	0.038	5.998	0.129	7.990	0.304	9.968	0.594	11.921	1.024	13.829	1.619	15.669	2.402	17.407	3.389	19.003	4.591	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_C	Length of Transition Curve to Chord Points in Metre											L.T.	S.T.	L.C.	Θ_s	s	K	R_D
	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0								
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10								
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″		metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 3	0 0 13	0 0 30	0 0 55	0 1 25	0 2 3	0 2 48	0 3 40	0 4 38	0 5 43		16.667	8.333	25.000	0 17 11	0.010	12.500	2500
2200	0 0 3	0 0 15	0 0 35	0 1 2	0 1 37	0 2 20	0 3 11	0 4 10	0 5 16	0 6 30		16.667	8.333	25.000	0 19 31	0.012	12.500	2200
2000	0 0 4	0 0 17	0 0 38	0 1 8	0 1 47	0 2 34	0 3 30	0 4 35	0 5 48	0 7 9		16.667	8.333	25.000	0 21 29	0.013	12.500	2000
1800	0 0 4	0 0 19	0 0 42	0 1 16	0 1 59	0 2 51	0 3 53	0 5 5	0 6 26	0 7 57		16.667	8.333	25.000	0 23 52	0.014	12.500	1800
1500	0 0 5	0 0 22	0 0 51	0 1 31	0 2 23	0 3 26	0 4 40	0 6 6	0 7 44	0 9 32		16.667	8.333	25.000	0 28 38	0.017	12.500	1500
1200	0 0 7	0 0 28	0 1 4	0 1 54	0 2 59	0 4 17	0 5 50	0 7 38	0 9 40	0 11 56		16.667	8.333	25.000	0 35 48	0.022	12.500	1200
1000	0 0 8	0 0 34	0 1 17	0 2 17	0 3 34	0 5 9	0 7 1	0 9 10	0 11 36	0 14 19		16.667	8.333	25.000	0 42 58	0.026	12.500	1000
900	0 0 9	0 0 38	0 1 25	0 2 32	0 3 58	0 5 43	0 7 47	0 10 11	0 12 53	0 15 54		16.667	8.333	25.000	0 47 44	0.029	12.500	900
800	0 0 10	0 0 42	0 1 36	0 2 51	0 4 28	0 6 26	0 8 46	0 11 27	0 14 30	0 17 54		16.667	8.334	25.000	0 53 42	0.033	12.500	800
700	0 0 12	0 0 49	0 1 50	0 3 16	0 5 6	0 7 21	0 10 1	0 13 5	0 16 34	0 20 27		16.667	8.334	25.000	1 1 23	0.037	12.500	700
600	0 0 14	0 0 57	0 2 8	0 3 49	0 5 58	0 8 35	0 11 41	0 15 16	0 19 20	0 23 52		16.667	8.334	25.000	1 11 37	0.043	12.500	600
500	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38		16.667	8.334	24.999	1 25 56	0.052	12.500	500
400	0 0 21	0 1 25	0 3 13	0 5 43	0 8 57	0 12 53	0 17 32	0 22 55	0 29 0	0 35 48		16.668	8.334	24.999	1 47 25	0.065	12.500	400
360	0 0 23	0 1 35	0 3 34	0 6 21	0 9 56	0 14 19	0 19 29	0 25 27	0 32 13	0 39 47		16.668	8.334	24.999	1 59 21	0.072	12.499	360
350	0 0 24	0 1 38	0 3 40	0 6 32	0 10 13	0 14 43	0 20 3	0 26 11	0 33 8	0 40 55		16.668	8.334	24.999	2 2 46	0.074	12.499	350
300	0 0 28	0 1 54	0 4 17	0 7 38	0 11 56	0 17 11	0 23 23	0 30 33	0 38 40	0 47 44		16.668	8.335	24.998	2 23 14	0.087	12.499	300
250	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17		16.669	8.335	24.997	2 51 53	0.104	12.499	250
230	0 0 37	0 2 29	0 5 36	0 9 57	0 15 34	0 22 25	0 30 30	0 39 51	0 50 26	1 2 16		16.669	8.336	24.997	3 6 50	0.113	12.499	230
200	0 0 42	0 2 51	0 6 26	0 11 27	0 17 54	0 25 46	0 35 5	0 45 50	0 58 0	1 11 37		16.670	8.336	24.996	3 34 51	0.130	12.498	200
170	0 0 50	0 3 22	0 7 34	0 13 28	0 21 3	0 30 19	0 41 17	0 53 55	1 8 14	1 24 15		16.671	8.338	24.994	4 12 46	0.153	12.498	170
155	0 0 55	0 3 41	0 8 19	0 14 47	0 23 6	0 33 16	0 45 16	0 59 8	1 14 51	1 32 24		16.672	8.339	24.993	4 37 14	0.168	12.497	155
125	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34		16.675	8.341	24.989	5 43 46	0.208	12.496	125
100	0 1 25	0 5 43	0 12 53	0 22 55	0 35 48	0 51 33	1 10 11	1 31 40	1 56 0	2 23 13		16.680	8.346	24.983	7 9 43	0.260	12.493	100
90	0 1 35	0 6 21	0 14 19	0 25 27	0 39 47	0 57 17	1 17 58	1 41 51	2 8 54	2 39 7		16.684	8.349	24.979	7 57 27	0.289	12.492	90
80	0 1 47	0 7 9	0 16 6	0 28 38	0 44 45	1 4 27	1 27 43	1 54 34	2 25 0	2 59 0		16.688	8.353	24.973	8 57 8	0.325	12.490	80
70	0 2 2	0 8 11	0 18 24	0 32 44	0 51 9	1 13 39	1 40 15	2 10 56	2 45 43	3 24 34		16.694	8.359	24.964	10 13 53	0.372	12.487	70
60	0 2 23	0 9 32	0 21 29	0 38 11	0 59 40	1 25 56	1 56 58	2 32 45	3 13 19	3 58 38		16.704	8.368	24.952	11 56 11	0.433	12.482	60
55	0 2 36	0 10 25	0 23 26	0 41 40	1 5 6	1 33 45	2 7 36	2 46 38	3 30 53	4 20 19		16.712	8.375	24.942	13 1 18	0.473	12.478	55
50	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19		16.721	8.383	24.930	14 19 26	0.520	12.474	50
45	0 3 10	0 12 43	0 28 38	0 50 55	1 19 34	1 54 34	2 35 56	3 23 39	4 17 43	5 18 6		16.734	8.395	24.914	15 54 55	0.577	12.467	45
40	0 3 34	0 14 19	0 32 13	0 57 17	1 29 31	2 8 54	2 55 26	3 49 6	4 49 54	5 57 48		16.752	8.412	24.891	17 54 17	0.649	12.458	40
35	0 4 5	0 16 22	0 36 49	1 5 28	1 42 18	2 27 18	3 20 28	4 21 48	5 31 15	6 48 48		16.778	8.436	24.857	20 27 46	0.741	12.445	35
33	0 4 20	0 17 21	0 39 3	1 9 26	1 48 30	2 36 14	3 32 37	4 37 39	5 51 18	7 13 31		16.791	8.449	24.839	21 42 10	0.785	12.438	33
30	0 4 46	0 19 5	0 42 58	1 16 23	1 59 21	2 51 51	3 53 52	5 5 23	6 26 22	7 56 45		16.817	8.474	24.804	23 52 23	0.863	12.425	30
25	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44		16.883	8.537	24.716	28 38 52	1.032	12.389	25
23	0 6 13	0 24 54	0 56 2	1 39 38	2 35 40	3 44 7	5 4 58	6 38 10	8 23 37	10 21 12		16.922	8.575	24.663	31 8 20	1.120	12.368	23
20	0 7 9	0 28 38	1 4 27	1 54 34	2 59 0	4 17 43	5 50 39	7 37 44	9 38 51	11 53 48		17.003	8.656	24.552	35 48 35	1.284	12.321	20
15	0 9 32	0 38 11	1 25 56	2 32 45	3 58 38	5 43 30	7 47 15	10 9 40	12 50 28	15 49 13		17.261	8.927	24.184	47 44 47	1.694	12.161	15
14	0 10 13	0 40 55	1 32 4	2 43 40	4 15 40	6 8 0	8 20 31	10 52 59	13 45 1	16 56 5		17.348	9.023	24.056	51 9 25	1.808	12.103	14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 25 metre

R_C metre	Length of Transition Curve to Chord Points in Metre																				R_C metre
	2.5		5.0		7.0		10.0		12.5		15.0		17.5		20.0		22.5		25.0		
	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	
2500	2.500	0.000	5.000	0.000	7.500	0.001	10.000	0.003	12.500	0.005	15.000	0.009	17.500	0.014	20.000	0.021	22.500	0.030	25.000	0.042	2500
2200	2.500	0.000	5.000	0.000	7.500	0.001	10.000	0.003	12.500	0.006	15.000	0.010	17.500	0.016	20.000	0.024	22.500	0.035	25.000	0.047	2200
2000	2.500	0.000	5.000	0.000	7.500	0.001	10.000	0.003	12.500	0.007	15.000	0.011	17.500	0.018	20.000	0.027	22.500	0.038	25.000	0.052	2000
1800	2.500	0.000	5.000	0.000	7.500	0.002	10.000	0.004	12.500	0.007	15.000	0.012	17.500	0.020	20.000	0.030	22.500	0.042	25.000	0.058	1800
1500	2.500	0.000	5.000	0.001	7.500	0.002	10.000	0.004	12.500	0.009	15.000	0.015	17.500	0.024	20.000	0.036	22.500	0.051	25.000	0.069	1500
1200	2.500	0.000	5.000	0.001	7.500	0.002	10.000	0.006	12.500	0.011	15.000	0.019	17.500	0.030	20.000	0.044	22.500	0.063	25.000	0.087	1200
1000	2.500	0.000	5.000	0.001	7.500	0.003	10.000	0.007	12.500	0.013	15.000	0.022	17.500	0.036	20.000	0.053	22.500	0.076	25.000	0.104	1000
900	2.500	0.000	5.000	0.001	7.500	0.003	10.000	0.007	12.500	0.014	15.000	0.025	17.500	0.040	20.000	0.059	22.500	0.084	25.000	0.116	900
800	2.500	0.000	5.000	0.001	7.500	0.004	10.000	0.008	12.500	0.016	15.000	0.028	17.500	0.045	20.000	0.067	22.500	0.095	24.999	0.130	800
700	2.500	0.000	5.000	0.001	7.500	0.004	10.000	0.010	12.500	0.019	15.000	0.032	17.500	0.051	20.000	0.076	22.500	0.108	24.999	0.149	700
600	2.500	0.000	5.000	0.001	7.500	0.005	10.000	0.011	12.500	0.022	15.000	0.037	17.500	0.060	20.000	0.089	22.499	0.127	24.999	0.174	600
500	2.500	0.000	5.000	0.002	7.500	0.006	10.000	0.013	12.500	0.026	15.000	0.045	17.500	0.071	19.999	0.107	22.499	0.152	24.998	0.208	500
400	2.500	0.000	5.000	0.002	7.500	0.007	10.000	0.017	12.500	0.033	15.000	0.056	17.500	0.089	19.999	0.133	22.499	0.190	24.998	0.260	400
360	2.500	0.000	5.000	0.002	7.500	0.008	10.000	0.019	12.500	0.036	15.000	0.062	17.499	0.099	19.999	0.148	22.498	0.211	24.997	0.289	360
350	2.500	0.000	5.000	0.002	7.500	0.008	10.000	0.019	12.500	0.037	15.000	0.064	17.499	0.102	19.999	0.152	22.498	0.217	24.997	0.298	350
300	2.500	0.000	5.000	0.003	7.500	0.009	10.000	0.022	12.500	0.043	15.000	0.075	17.499	0.119	19.999	0.178	22.497	0.253	24.996	0.347	300
250	2.500	0.000	5.000	0.003	7.500	0.011	10.000	0.027	12.500	0.052	15.000	0.090	17.499	0.143	19.998	0.213	22.496	0.304	24.994	0.417	250
230	2.500	0.000	5.000	0.004	7.500	0.012	10.000	0.029	12.500	0.057	14.999	0.098	17.499	0.155	19.998	0.232	22.496	0.330	24.993	0.453	230
200	2.500	0.001	5.000	0.004	7.500	0.014	10.000	0.033	12.500	0.065	14.999	0.112	17.498	0.179	19.997	0.267	22.494	0.380	24.990	0.521	200
170	2.500	0.001	5.000	0.005	7.500	0.017	10.000	0.039	12.500	0.077	14.999	0.132	17.498	0.210	19.996	0.314	22.492	0.447	24.986	0.613	170
155	2.500	0.001	5.000	0.005	7.500	0.018	10.000	0.043	12.499	0.084	14.999	0.145	17.497	0.230	19.995	0.344	22.490	0.490	24.984	0.672	155
125	2.500	0.001	5.000	0.007	7.500	0.022	10.000	0.053	12.499	0.104	14.998	0.180	17.496	0.286	19.992	0.427	22.485	0.607	24.975	0.833	125
100	2.500	0.001	5.000	0.008	7.500	0.028	10.000	0.067	12.499	0.130	14.997	0.225	17.493	0.357	19.987	0.533	22.477	0.759	24.961	1.041	100
90	2.500	0.001	5.000	0.009	7.500	0.031	10.000	0.074	12.498	0.145	14.996	0.250	17.492	0.397	19.984	0.592	22.472	0.843	24.952	1.156	90
80	2.500	0.001	5.000	0.010	7.500	0.035	9.999	0.083	12.498	0.163	14.995	0.281	17.490	0.446	19.980	0.666	22.464	0.948	24.939	1.300	80
70	2.500	0.001	5.000	0.012	7.500	0.040	9.999	0.095	12.498	0.186	14.994	0.321	17.487	0.510	19.974	0.761	22.453	1.083	24.920	1.485	70
60	2.500	0.002	5.000	0.014	7.500	0.047	9.999	0.111	12.497	0.217	14.992	0.375	17.482	0.595	19.964	0.888	22.436	1.263	24.892	1.731	60
55	2.500	0.002	5.000	0.015	7.500	0.051	9.999	0.121	12.496	0.237	14.990	0.409	17.478	0.649	19.958	0.968	22.424	1.377	24.871	1.887	55
50	2.500	0.002	5.000	0.017	7.500	0.056	9.998	0.133	12.495	0.260	14.988	0.450	17.474	0.714	19.949	1.065	22.408	1.514	24.844	2.074	50
45	2.500	0.002	5.000	0.019	7.500	0.062	9.998	0.148	12.494	0.289	14.985	0.500	17.468	0.793	19.937	1.183	22.386	1.681	24.808	2.302	45
40	2.500	0.003	5.000	0.021	7.499	0.070	9.998	0.167	12.492	0.325	14.981	0.562	17.459	0.892	19.920	1.330	22.356	1.890	24.757	2.586	40
35	2.500	0.003	5.000	0.024	7.499	0.080	9.997	0.190	12.490	0.372	14.975	0.642	17.446	1.019	19.896	1.518	22.312	2.157	24.683	2.949	35
33	2.500	0.003	5.000	0.025	7.499	0.085	9.996	0.202	12.489	0.394	14.972	0.681	17.440	1.080	19.883	1.609	22.289	2.286	24.644	3.124	33
30	2.500	0.003	5.000	0.028	7.499	0.094	9.995	0.222	12.486	0.434	14.966	0.749	17.427	1.187	19.858	1.769	22.245	2.511	24.569	3.429	30
25	2.500	0.004	5.000	0.033	7.498	0.112	9.994	0.267	12.480	0.520	14.951	0.898	17.395	1.423	19.796	2.118	22.134	3.002	24.382	4.093	25
23	2.500	0.005	5.000	0.036	7.498	0.122	9.992	0.290	12.477	0.565	14.943	0.976	17.376	1.546	19.759	2.299	22.068	3.256	24.272	4.434	23
20	2.500	0.005	5.000	0.042	7.498	0.141	9.990	0.333	12.470	0.650	14.924	1.121	17.337	1.775	19.682	2.636	21.930	3.728	24.041	5.065	20
15	2.500	0.007	4.999	0.056	7.496	0.187	9.982	0.444	12.446	0.865	14.866	1.490	17.210	2.354	19.439	3.484	21.496	4.900	23.319	6.607	15
14	2.500	0.007	4.999	0.060	7.495	0.201	9.980	0.475	12.438	0.927	14.846	1.595	17.168	2.517	19.357	3.722	21.351	5.225	23.079	7.027	14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 30 metre

R_C	Length of Transition Curve to Chord Points in Metre										L.T.	S.T.	L.C.	Θ_s	s	K	R_O
	3.0	6.0	9.0	12.0	15.0	18.0	21.0	24.0	27.0	30.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 4	0 0 16	0 0 37	0 1 6	0 1 43	0 2 28	0 3 22	0 4 24	0 5 34	0 6 52	20.000	10.000	30.000	0 20 37	0.015	15.000	**2500**
2200	0 0 4	0 0 18	0 0 42	0 1 15	0 1 57	0 2 48	0 3 49	0 5 0	0 6 19	0 7 48	20.000	10.000	30.000	0 23 26	0.017	15.000	**2200**
2000	0 0 5	0 0 20	0 0 46	0 1 22	0 2 8	0 3 5	0 4 12	0 5 30	0 6 57	0 8 35	20.000	10.000	30.000	0 25 46	0.019	15.000	**2000**
1800	0 0 5	0 0 22	0 0 51	0 1 31	0 2 23	0 3 26	0 4 40	0 6 6	0 7 44	0 9 32	20.000	10.000	30.000	0 28 38	0.021	15.000	**1800**
1500	0 0 6	0 0 27	0 1 1	0 1 50	0 2 51	0 4 7	0 5 36	0 7 20	0 9 16	0 11 27	20.000	10.000	30.000	0 34 22	0.025	15.000	**1500**
1200	0 0 8	0 0 34	0 1 17	0 2 17	0 3 34	0 5 9	0 7 1	0 9 10	0 11 36	0 14 19	20.000	10.000	30.000	0 42 58	0.031	15.000	**1200**
1000	0 0 10	0 0 41	0 1 32	0 2 45	0 4 17	0 6 11	0 8 25	0 11 0	0 13 55	0 17 11	20.000	10.000	30.000	0 51 33	0.037	15.000	**1000**
900	0 0 11	0 0 45	0 1 43	0 3 3	0 4 46	0 6 52	0 9 21	0 12 13	0 15 28	0 19 5	20.000	10.000	30.000	0 57 17	0.042	15.000	**900**
800	0 0 12	0 0 51	0 1 56	0 3 26	0 5 22	0 7 44	0 10 31	0 13 45	0 17 24	0 21 29	20.000	10.000	30.000	1 4 27	0.047	15.000	**800**
700	0 0 14	0 0 58	0 2 12	0 3 55	0 6 8	0 8 50	0 12 1	0 15 42	0 19 53	0 24 33	20.000	10.000	29.999	1 13 39	0.054	15.000	**700**
600	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	20.001	10.001	29.999	1 25 56	0.062	15.000	**600**
500	0 0 20	0 1 22	0 3 5	0 5 30	0 8 35	0 12 22	0 16 50	0 22 0	0 27 50	0 34 22	20.001	10.001	29.999	1 43 7	0.075	15.000	**500**
400	0 0 25	0 1 43	0 3 52	0 6 52	0 10 44	0 15 28	0 21 3	0 27 30	0 34 48	0 42 58	20.001	10.001	29.998	2 8 54	0.094	14.999	**400**
360	0 0 28	0 1 54	0 4 17	0 7 38	0 11 56	0 17 11	0 23 23	0 30 33	0 38 40	0 47 44	20.002	10.002	29.998	2 23 14	0.104	14.999	**360**
350	0 0 29	0 1 57	0 4 25	0 7 51	0 12 16	0 17 40	0 24 3	0 31 25	0 39 46	0 49 6	20.002	10.002	29.998	2 27 19	0.107	14.999	**350**
300	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17	20.003	10.002	29.997	2 51 53	0.125	14.999	**300**
250	0 0 41	0 2 45	0 6 11	0 11 0	0 17 11	0 24 45	0 33 41	0 44 0	0 55 41	1 8 45	20.004	10.003	29.995	3 26 15	0.150	14.998	**250**
230	0 0 44	0 2 59	0 6 43	0 11 57	0 18 41	0 26 54	0 36 37	0 47 49	1 0 31	1 14 43	20.004	10.004	29.994	3 44 12	0.163	14.998	**230**
200	0 0 51	0 3 26	0 7 44	0 13 45	0 21 29	0 30 56	0 42 6	0 55 0	1 9 36	1 25 56	20.006	10.005	29.993	4 17 49	0.187	14.997	**200**
170	0 1 0	0 4 2	0 9 5	0 16 10	0 25 16	0 36 23	0 49 32	1 4 42	1 21 53	1 41 6	20.008	10.007	29.990	5 3 19	0.221	14.996	**170**
155	0 1 6	0 4 26	0 9 58	0 17 44	0 27 43	0 39 55	0 54 20	1 10 58	1 29 49	1 50 53	20.010	10.009	29.988	5 32 41	0.242	14.995	**155**
125	0 1 22	0 5 30	0 12 22	0 22 0	0 34 22	0 49 30	1 7 22	1 28 0	1 51 22	2 17 29	20.015	10.014	29.981	6 52 31	0.300	14.993	**125**
100	0 1 43	0 6 52	0 15 28	0 27 30	0 42 58	1 1 52	1 24 13	1 49 59	2 19 12	2 51 51	20.024	10.021	29.970	8 35 39	0.375	14.989	**100**
90	0 1 54	0 7 38	0 17 11	0 30 33	0 47 44	1 8 45	1 33 34	2 2 13	2 34 40	3 10 56	20.029	10.027	29.963	9 32 57	0.416	14.986	**90**
80	0 2 8	0 8 35	0 19 20	0 34 22	0 53 42	1 17 20	1 45 16	2 17 29	2 54 0	3 34 47	20.037	10.034	29.953	10 44 34	0.468	14.982	**80**
70	0 2 27	0 9 49	0 22 5	0 39 17	1 1 23	1 28 23	2 0 18	2 37 7	3 18 50	4 5 27	20.048	10.044	29.939	12 16 39	0.535	14.977	**70**
60	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	20.065	10.060	29.916	14 19 26	0.624	14.968	**60**
55	0 3 7	0 12 30	0 28 7	0 50 0	1 18 7	1 52 29	2 33 6	3 19 57	4 13 2	5 12 19	20.078	10.071	29.900	15 37 34	0.680	14.962	**55**
50	0 3 26	0 13 45	0 30 56	0 55 0	1 25 56	2 3 44	2 48 25	3 39 56	4 38 19	5 43 30	20.094	10.087	29.879	17 11 19	0.748	14.954	**50**
45	0 3 49	0 15 16	0 34 22	1 1 6	1 35 29	2 17 29	3 7 7	4 4 22	5 9 12	6 21 36	20.116	10.107	29.850	19 5 54	0.830	14.943	**45**
40	0 4 17	0 17 11	0 38 40	1 8 45	1 47 25	2 34 40	3 30 30	4 34 53	5 47 47	7 9 12	20.147	10.136	29.810	21 29 9	0.933	14.927	**40**
35	0 4 54	0 19 38	0 44 11	1 18 34	2 2 45	2 56 45	4 0 33	5 14 6	6 37 23	8 10 20	20.191	10.178	29.751	24 33 19	1.064	14.904	**35**
33	0 5 12	0 20 50	0 46 52	1 23 20	2 10 12	3 7 28	4 15 7	5 33 7	7 1 25	8 39 57	20.215	10.201	29.720	26 2 36	1.128	14.891	**33**
30	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	20.260	10.244	29.659	28 38 52	1.239	14.867	**30**
25	0 6 52	0 27 30	1 1 52	1 49 59	2 51 51	4 7 25	5 36 39	7 19 28	9 15 47	11 25 26	20.373	10.356	29.505	34 22 28	1.481	14.804	**25**
23	0 7 28	0 29 53	1 7 15	1 59 33	3 6 47	4 28 54	6 5 52	7 57 35	10 3 54	12 24 37	20.440	10.424	29.412	37 22 0	1.606	14.765	**23**
20	0 8 35	0 34 22	1 17 20	2 17 29	3 34 47	5 9 12	7 0 38	9 8 57	11 33 56	14 15 17	20.580	10.569	29.215	42 58 18	1.838	14.680	**20**
15	0 11 27	0 45 30	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58	21.023	11.062	28.559	57 17 44	2.413	14.378	**15**
14	0 12 16	0 49 6	1 50 29	3 16 23	5 6 45	7 21 26	10 0 11	13 2 36	16 28 2	20 15 29	21.174	11.240	28.330	61 23 18	2.571	14.266	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=30 meter

R_C	Length of Transition Curve to Chord Points in Metre																R_C				
	3.0		6.0		9.0		12.0		15.0		18.0		21.0		24.0		27.0		30.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	3.000	0.000	6.000	0.000	9.000	0.002	12.000	0.004	15.000	0.008	18.000	0.013	21.000	0.021	24.000	0.031	27.000	0.044	30.000	0.060	2500
2200	3.000	0.000	6.000	0.001	9.000	0.002	12.000	0.004	15.000	0.009	18.000	0.015	21.000	0.023	24.000	0.035	27.000	0.050	30.000	0.068	2200
2000	3.000	0.000	6.000	0.001	9.000	0.002	12.000	0.005	15.000	0.009	18.000	0.016	21.000	0.026	24.000	0.038	27.000	0.055	30.000	0.075	2000
1800	3.000	0.000	6.000	0.001	9.000	0.002	12.000	0.005	15.000	0.010	18.000	0.018	21.000	0.029	24.000	0.043	27.000	0.061	30.000	0.083	1800
1500	3.000	0.000	6.000	0.001	9.000	0.003	12.000	0.006	15.000	0.012	18.000	0.022	21.000	0.034	24.000	0.051	27.000	0.073	30.000	0.100	1500
1200	3.000	0.000	6.000	0.001	9.000	0.003	12.000	0.008	15.000	0.016	18.000	0.027	21.000	0.043	24.000	0.064	27.000	0.091	30.000	0.125	1200
1000	3.000	0.000	6.000	0.001	9.000	0.004	12.000	0.010	15.000	0.019	18.000	0.032	21.000	0.051	24.000	0.077	27.000	0.109	29.999	0.150	1000
900	3.000	0.000	6.000	0.001	9.000	0.005	12.000	0.011	15.000	0.021	18.000	0.036	21.000	0.057	24.000	0.085	27.000	0.121	29.999	0.167	900
800	3.000	0.000	6.000	0.002	9.000	0.005	12.000	0.012	15.000	0.023	18.000	0.040	21.000	0.064	24.000	0.096	26.999	0.137	29.999	0.187	800
700	3.000	0.000	6.000	0.002	9.000	0.006	12.000	0.014	15.000	0.027	18.000	0.046	21.000	0.073	24.000	0.110	26.999	0.156	29.999	0.214	700
600	3.000	0.000	6.000	0.002	9.000	0.007	12.000	0.016	15.000	0.031	18.000	0.054	21.000	0.086	23.999	0.128	26.999	0.182	29.998	0.250	600
500	3.000	0.000	6.000	0.002	9.000	0.008	12.000	0.019	15.000	0.037	18.000	0.065	21.000	0.103	23.999	0.154	26.998	0.219	29.997	0.300	500
400	3.000	0.000	6.000	0.003	9.000	0.010	12.000	0.024	15.000	0.047	18.000	0.081	20.999	0.129	23.999	0.192	26.998	0.273	29.996	0.375	400
360	3.000	0.000	6.000	0.003	9.000	0.011	12.000	0.027	15.000	0.052	18.000	0.090	20.999	0.143	23.998	0.213	26.997	0.304	29.995	0.417	360
350	3.000	0.000	6.000	0.003	9.000	0.012	12.000	0.027	15.000	0.054	18.000	0.093	20.999	0.147	23.998	0.219	26.997	0.312	29.994	0.429	350
300	3.000	0.001	6.000	0.004	9.000	0.013	12.000	0.032	15.000	0.062	17.999	0.108	20.999	0.171	23.998	0.256	26.996	0.364	29.993	0.500	300
250	3.000	0.001	6.000	0.005	9.000	0.016	12.000	0.038	15.000	0.075	17.999	0.130	20.998	0.206	23.996	0.307	26.994	0.437	29.989	0.600	250
230	3.000	0.001	6.000	0.005	9.000	0.018	12.000	0.042	15.000	0.082	17.999	0.141	20.998	0.224	23.996	0.334	26.992	0.475	29.987	0.652	230
200	3.000	0.001	6.000	0.006	9.000	0.020	12.000	0.048	14.999	0.094	17.999	0.162	20.997	0.257	23.994	0.384	26.990	0.547	29.983	0.750	200
170	3.000	0.001	6.000	0.007	9.000	0.024	12.000	0.056	14.999	0.110	17.998	0.191	20.996	0.303	23.992	0.452	26.986	0.643	29.977	0.882	170
155	3.000	0.001	6.000	0.008	9.000	0.026	12.000	0.062	14.999	0.121	17.998	0.209	20.995	0.332	23.991	0.495	26.983	0.705	29.972	0.967	155
125	3.000	0.001	6.000	0.010	9.000	0.032	12.000	0.077	14.999	0.150	17.997	0.259	20.993	0.411	23.986	0.614	26.975	0.874	29.957	1.199	125
100	3.000	0.001	6.000	0.012	9.000	0.040	11.999	0.096	14.998	0.187	17.995	0.324	20.989	0.514	23.978	0.767	26.960	1.092	29.933	1.498	100
90	3.000	0.002	6.000	0.013	9.000	0.045	11.999	0.107	14.997	0.208	17.994	0.360	20.986	0.571	23.973	0.853	26.951	1.213	29.917	1.663	90
80	3.000	0.002	6.000	0.015	9.000	0.051	11.999	0.120	14.997	0.234	17.992	0.405	20.982	0.643	23.965	0.959	26.938	1.365	29.895	1.870	80
70	3.000	0.002	6.000	0.017	9.000	0.058	11.999	0.137	14.996	0.268	17.989	0.463	20.977	0.734	23.955	1.096	26.919	1.559	29.863	2.136	70
60	3.000	0.002	6.000	0.020	9.000	0.067	11.998	0.160	14.994	0.312	17.985	0.540	20.969	0.857	23.939	1.278	26.889	1.817	29.813	2.489	60
55	3.000	0.003	6.000	0.022	8.999	0.074	11.998	0.175	14.993	0.341	17.983	0.589	20.963	0.934	23.927	1.393	26.869	1.981	29.778	2.713	55
50	3.000	0.003	6.000	0.024	8.999	0.081	11.997	0.192	14.992	0.375	17.979	0.647	20.955	1.027	23.912	1.532	26.841	2.178	29.731	2.981	50
45	3.000	0.003	6.000	0.027	8.999	0.090	11.997	0.213	14.990	0.416	17.974	0.719	20.944	1.141	23.891	1.701	26.804	2.417	29.668	3.307	45
40	3.000	0.004	6.000	0.030	8.999	0.101	11.996	0.240	14.987	0.468	17.967	0.809	20.929	1.283	23.862	1.912	26.752	2.716	29.581	3.713	40
35	3.000	0.004	6.000	0.034	8.999	0.116	11.994	0.274	14.983	0.535	17.957	0.924	20.908	1.465	23.820	2.183	26.676	3.097	29.454	4.230	35
33	3.000	0.005	6.000	0.036	8.998	0.123	11.994	0.291	14.981	0.568	17.952	0.980	20.896	1.554	23.798	2.313	26.636	3.282	29.386	4.479	33
30	3.000	0.005	6.000	0.040	8.998	0.135	11.992	0.320	14.977	0.624	17.942	1.078	20.874	1.708	23.755	2.541	26.560	3.603	29.259	4.911	30
25	3.000	0.006	6.000	0.048	8.997	0.162	11.989	0.384	14.966	0.749	17.916	1.292	20.819	2.045	23.649	3.040	26.369	4.301	28.938	5.847	25
23	3.000	0.007	6.000	0.052	8.997	0.176	11.987	0.417	14.960	0.814	17.901	1.403	20.787	2.221	23.585	3.298	26.256	4.660	28.749	6.326	23
20	3.000	0.007	5.999	0.060	8.996	0.202	11.983	0.480	14.947	0.935	17.869	1.612	20.718	2.548	23.453	3.777	26.020	5.325	28.356	7.204	20
15	3.000	0.010	5.999	0.080	8.993	0.270	11.969	0.639	14.907	1.244	17.768	2.140	20.501	3.372	23.035	4.972	25.282	6.955	27.136	9.308	15
14	3.000	0.011	5.999	0.086	8.992	0.289	11.965	0.684	14.893	1.332	17.734	2.290	20.429	3.603	22.896	5.304	25.036	7.400	26.734	9.867	14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=35 metre

R_C	Length of Transition Curve to Chord Points in Metre											L.T.	S.T.	L.C.	Θ_s	s	K	R_C
	3.5	7.0	10.5	14.0	17.5	21.0	24.5	28.0	31.5	35.0								
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10								
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″		metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 4	0 0 19	0 0 43	0 1 17	0 2 0	0 2 53	0 3 55	0 5 8	0 6 29	0 8 1		23.333	11.667	35.000	0 24 3	0.020	17.500	**2500**
2200	0 0 5	0 0 21	0 0 49	0 1 27	0 2 16	0 3 16	0 4 27	0 5 50	0 7 23	0 9 6		23.333	11.667	35.000	0 27 20	0.023	17.500	**2200**
2000	0 0 6	0 0 24	0 0 54	0 1 36	0 2 30	0 3 36	0 4 54	0 6 25	0 8 7	0 10 1		23.333	11.667	35.000	0 30 4	0.025	17.500	**2000**
1800	0 0 6	0 0 26	0 1 0	0 1 46	0 2 47	0 4 0	0 5 27	0 7 7	0 9 1	0 11 8		23.333	11.667	35.000	0 33 25	0.028	17.500	**1800**
1500	0 0 8	0 0 32	0 1 12	0 2 8	0 3 20	0 4 48	0 6 33	0 8 33	0 10 49	0 13 22		23.333	11.667	35.000	0 40 6	0.034	17.500	**1500**
1200	0 0 10	0 0 40	0 1 30	0 2 40	0 4 10	0 6 0	0 8 11	0 10 41	0 13 32	0 16 42		23.334	11.667	35.000	0 50 8	0.042	17.500	**1200**
1000	0 0 12	0 0 48	0 1 48	0 3 12	0 5 0	0 7 13	0 9 49	0 12 50	0 16 14	0 20 3		23.334	11.667	35.000	1 0 9	0.051	17.500	**1000**
900	0 0 13	0 0 53	0 2 0	0 3 33	0 5 34	0 8 1	0 10 55	0 14 15	0 18 2	0 22 16		23.334	11.667	34.999	1 6 50	0.057	17.500	**900**
800	0 0 15	0 1 0	0 2 15	0 4 0	0 6 16	0 9 1	0 12 16	0 16 2	0 20 18	0 25 4		23.334	11.667	34.999	1 15 12	0.064	17.500	**800**
700	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38		23.334	11.667	34.999	1 25 56	0.073	17.500	**700**
600	0 0 20	0 1 20	0 3 0	0 5 20	0 8 21	0 12 1	0 16 22	0 21 23	0 27 4	0 33 25		23.334	11.668	35.999	1 40 16	0.085	17.500	**600**
500	0 0 24	0 1 36	0 3 36	0 6 25	0 10 1	0 14 26	0 19 39	0 25 40	0 32 29	0 40 6		23.335	11.668	34.998	2 0 19	0.102	17.499	**500**
400	0 0 30	0 2 0	0 4 30	0 8 1	0 12 32	0 18 2	0 24 33	0 32 5	0 40 36	0 50 7		23.336	11.669	34.997	2 30 24	0.128	17.499	**400**
360	0 0 33	0 2 13	0 5 0	0 8 54	0 13 55	0 20 3	0 27 17	0 35 39	0 45 7	0 55 42		23.336	11.669	34.996	2 47 6	0.142	17.499	**360**
350	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17		23.336	11.669	34.996	2 51 53	0.146	17.499	**350**
300	0 0 40	0 2 40	0 6 0	0 10 41	0 16 42	0 24 3	0 32 45	0 42 46	0 54 8	1 6 50		23.337	11.670	34.995	3 20 32	0.170	17.498	**300**
250	0 0 48	0 3 12	0 7 13	0 12 50	0 20 3	0 28 52	0 39 18	0 51 20	1 4 58	1 20 12		23.339	11.672	34.992	4 0 38	0.204	17.497	**250**
230	0 0 52	0 3 29	0 7 50	0 13 57	0 21 47	0 31 23	0 42 43	0 55 48	1 10 37	1 27 11		23.340	11.673	34.991	4 21 34	0.222	17.497	**230**
200	0 1 0	0 4 0	0 9 1	0 16 2	0 25 4	0 36 5	0 49 7	1 4 10	1 21 12	1 40 15		23.343	11.675	34.988	5 0 48	0.255	17.496	**200**
170	0 1 10	0 4 43	0 10 36	0 18 52	0 29 29	0 42 27	0 57 48	1 15 29	1 35 32	1 57 57		23.346	11.678	34.984	5 53 53	0.300	17.494	**170**
155	0 1 17	0 5 10	0 11 38	0 20 42	0 32 20	0 46 34	1 3 23	1 22 47	1 44 47	2 9 21		23.349	11.681	34.980	6 28 7	0.329	17.493	**155**
125	0 1 36	0 6 25	0 14 26	0 25 40	0 40 6	0 57 45	1 18 36	1 42 40	2 9 55	2 40 24		23.357	11.688	34.969	8 1 17	0.408	17.489	**125**
100	0 2 0	0 8 1	0 18 2	0 32 5	0 50 7	1 12 11	1 38 15	2 8 19	2 42 24	3 20 29		23.371	11.701	34.952	10 1 36	0.510	17.482	**100**
90	0 2 13	0 8 54	0 20 3	0 35 39	0 55 42	1 20 12	1 49 10	2 22 35	3 0 26	3 42 44		23.379	11.709	34.941	11 8 27	0.566	17.478	**90**
80	0 2 30	0 10 1	0 22 33	0 40 6	1 2 39	1 30 14	2 2 48	2 40 24	3 22 59	4 10 34		23.392	11.720	34.925	12 32 0	0.637	17.472	**80**
70	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19		23.410	11.737	34.902	14 19 26	0.728	17.463	**70**
60	0 3 20	0 13 22	0 30 4	0 53 28	1 23 33	2 0 18	2 43 44	3 33 50	4 30 35	5 33 59		23.437	11.762	34.867	16 42 40	0.848	17.449	**60**
55	0 3 38	0 14 35	0 32 48	0 58 20	1 31 8	2 11 14	2 58 37	3 53 16	4 55 10	6 4 17		23.457	11.780	34.841	18 13 49	0.925	17.439	**55**
50	0 4 0	0 16 2	0 36 5	1 4 10	1 40 15	2 24 21	3 16 28	4 16 34	5 24 38	6 40 39		23.482	11.805	34.807	20 3 12	1.016	17.426	**50**
45	0 4 27	0 17 49	0 40 6	1 11 17	1 51 23	2 40 24	3 38 17	4 45 3	6 0 39	7 25 3		23.517	11.837	34.762	22 16 54	1.128	17.408	**45**
40	0 5 0	0 20 3	0 45 7	1 20 12	2 5 19	3 0 26	4 5 33	5 20 38	6 45 39	8 20 31		23.566	11.884	34.697	25 4 0	1.267	17.383	**40**
35	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44		23.636	11.952	34.603	28 38 52	1.445	17.345	**35**
33	0 6 4	0 24 18	0 54 41	1 37 13	2 31 53	3 38 41	4 57 35	6 28 32	8 11 27	10 6 13		23.674	11.988	34.552	30 23 2	1.531	17.325	**33**
30	0 6 41	0 26 44	1 0 9	1 46 56	2 47 4	4 0 33	5 27 18	7 7 18	9 0 25	11 6 30		23.745	12.058	34.455	33 25 21	1.681	17.285	**30**
25	0 8 1	0 32 5	1 12 11	2 8 19	3 20 28	4 48 36	6 32 39	8 32 29	10 47 57	13 18 46		23.923	12.240	34.206	40 6 25	2.006	17.180	**25**
23	0 8 43	0 34 52	1 18 28	2 19 29	3 37 54	5 13 40	7 6 43	9 16 53	11 43 56	14 27 33		24.029	12.351	34.056	43 45 40	2.174	17.114	**23**
20	0 10 1	0 40 6	1 30 14	2 40 24	4 10 34	6 0 39	8 10 32	10 39 59	13 28 40	16 36 3		24.250	12.590	33.734	50 8 1	2.483	16.969	**20**
15	0 13 22	0 53 28	2 0 18	3 33 50	5 33 59	8 0 33	10 53 15	14 11 31	17 54 31	22 0 58		24.957	13.425	32.659	66 50 42	3.242	16.444	**15**
14	0 14 19	0 57 17	2 8 54	3 49 6	5 57 48	8 34 46	11 39 37	15 11 41	19 9 55	23 32 42		25.200	13.735	32.280	71 37 11	3.449	16.345	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_C	Length of Transition Curve to Chord Points in Metre																				L_S = 35 meter	R_C
	3.5		7.0		10.5		14.0		17.5		21.0		24.5		28.0		31.5		35.0			
	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10		
metre																						metre
2500	3.500	0.000	7.000	0.001	10.500	0.002	14.000	0.005	17.500	0.010	21.000	0.018	24.500	0.028	28.000	0.042	31.500	0.060	35.000	0.082		**2500**
2200	3.500	0.000	7.000	0.001	10.500	0.003	14.000	0.006	17.500	0.012	21.000	0.020	24.500	0.032	28.000	0.048	31.500	0.068	35.000	0.093		**2200**
2000	3.500	0.000	7.000	0.001	10.500	0.003	14.000	0.007	17.500	0.013	21.000	0.022	24.500	0.035	28.000	0.052	31.500	0.074	35.000	0.102		**2000**
1800	3.500	0.000	7.000	0.001	10.500	0.003	14.000	0.007	17.500	0.014	21.000	0.024	24.500	0.039	28.000	0.058	31.500	0.083	35.000	0.113		**1800**
1500	3.500	0.000	7.000	0.001	10.500	0.004	14.000	0.009	17.500	0.017	21.000	0.029	24.500	0.047	28.000	0.070	31.500	0.099	35.000	0.136		**1500**
1200	3.500	0.000	7.000	0.001	10.500	0.005	14.000	0.011	17.500	0.021	21.000	0.037	24.500	0.058	28.000	0.087	31.500	0.124	34.999	0.170		**1200**
1000	3.500	0.000	7.000	0.002	10.500	0.006	14.000	0.013	17.500	0.026	21.000	0.044	24.500	0.070	28.000	0.105	31.499	0.149	34.999	0.204		**1000**
900	3.500	0.000	7.000	0.002	10.500	0.006	14.000	0.015	17.500	0.028	21.000	0.049	24.500	0.078	28.000	0.116	31.499	0.165	34.999	0.227		**900**
800	3.500	0.000	7.000	0.002	10.500	0.007	14.000	0.016	17.500	0.032	21.000	0.055	24.500	0.088	27.999	0.131	31.499	0.186	34.998	0.255		**800**
700	3.500	0.000	7.000	0.002	10.500	0.008	14.000	0.019	17.500	0.036	21.000	0.063	24.500	0.100	27.999	0.149	31.499	0.213	34.998	0.292		**700**
600	3.500	0.000	7.000	0.003	10.500	0.009	14.000	0.022	17.500	0.043	21.000	0.073	24.499	0.117	27.999	0.174	31.498	0.248	34.997	0.340		**600**
500	3.500	0.000	7.000	0.003	10.500	0.011	14.000	0.026	17.500	0.051	21.000	0.088	24.499	0.140	27.999	0.209	31.497	0.298	34.996	0.408		**500**
400	3.500	0.001	7.000	0.004	10.500	0.014	14.000	0.033	17.500	0.064	20.999	0.110	24.499	0.175	27.998	0.261	31.496	0.372	34.993	0.510		**400**
360	3.500	0.001	7.000	0.005	10.500	0.015	14.000	0.036	17.500	0.071	20.999	0.122	24.499	0.195	27.997	3.290	31.495	0.413	34.992	0.567		**360**
350	3.500	0.001	7.000	0.005	10.500	0.016	14.000	0.037	17.500	0.073	20.999	0.126	24.499	0.200	27.997	0.299	31.495	0.425	34.991	0.583		**350**
300	3.500	0.001	7.000	0.005	10.500	0.018	14.000	0.044	17.500	0.085	20.999	0.147	24.498	0.233	27.996	0.348	31.493	0.496	34.988	0.680		**300**
250	3.500	0.001	7.000	0.007	10.500	0.022	14.000	0.052	17.499	0.102	20.999	0.176	24.497	0.280	27.994	0.418	31.490	0.595	34.983	0.816		**250**
230	3.500	0.001	7.000	0.007	10.500	0.024	14.000	0.057	17.499	0.111	20.998	0.192	24.497	0.304	27.993	0.454	31.488	0.647	34.980	0.887		**230**
200	3.500	0.001	7.000	0.008	10.500	0.028	14.000	0.065	17.499	0.128	20.998	0.220	24.495	0.350	27.991	0.523	31.484	0.744	34.973	1.020		**200**
170	3.500	0.001	7.000	0.010	10.500	0.032	14.000	0.077	17.499	0.150	20.997	0.259	24.494	0.412	27.988	0.615	31.478	0.875	34.963	1.200		**170**
155	3.500	0.001	7.000	0.011	10.500	0.036	14.000	0.084	17.499	0.165	20.997	0.284	24.493	0.452	27.985	0.674	31.474	0.960	34.955	1.316		**155**
125	3.500	0.002	7.000	0.013	10.500	0.044	13.999	0.105	17.498	6.204	20.995	0.353	24.488	0.560	27.978	0.836	31.460	1.190	34.931	1.631		**125**
100	3.500	0.002	7.000	0.016	10.500	0.055	13.999	0.131	17.497	0.255	20.992	0.441	24.482	0.700	27.965	1.044	31.437	1.486	34.893	2.037		**100**
90	3.500	0.002	7.000	0.018	10.500	0.061	13.999	0.145	17.496	0.284	20.990	0.490	24.478	0.778	27.957	1.160	31.422	1.651	34.868	2.262		**90**
80	3.500	0.003	7.000	0.020	10.500	0.069	13.998	0.163	17.495	0.319	20.987	0.551	24.472	0.875	27.945	1.305	31.401	1.856	34.833	2.543		**80**
70	3.500	0.003	7.000	0.023	10.499	0.079	13.998	0.187	17.493	0.364	20.983	0.630	24.463	0.999	27.928	1.491	31.371	2.120	34.782	2.904		**70**
60	3.500	0.003	7.000	0.027	10.499	0.092	13.997	0.218	17.491	0.425	20.977	0.734	24.450	1.165	27.903	1.738	31.325	2.471	34.703	3.382		**60**
55	3.500	0.004	7.000	0.030	10.499	0.100	13.996	0.238	17.489	0.464	20.972	0.801	24.441	1.271	27.884	1.895	31.291	2.693	34.647	3.685		**55**
50	3.500	0.004	7.000	0.033	10.499	0.110	13.996	0.261	17.487	0.510	20.967	0.881	24.428	1.398	27.860	2.083	31.248	2.960	34.574	4.048		**50**
45	3.500	0.005	7.000	0.036	10.499	0.122	13.995	0.290	17.483	0.567	20.959	0.979	24.411	1.552	27.827	2.313	31.189	3.284	34.474	4.488		**45**
40	3.500	0.005	7.000	0.041	10.498	0.138	13.993	0.327	17.479	0.637	20.948	1.101	24.388	1.745	27.781	2.599	31.107	3.688	34.336	5.035		**40**
35	3.500	0.006	7.000	0.047	10.498	0.157	13.991	0.373	17.473	0.728	20.932	1.257	24.353	1.992	27.715	2.965	30.987	4.203	34.135	5.730		**35**
33	3.500	0.006	7.000	0.049	10.498	0.167	13.990	0.396	17.469	0.772	20.924	1.333	24.335	2.112	27.679	3.142	30.924	4.451	34.028	6.064		**33**
30	3.500	0.007	7.000	0.054	10.497	0.184	13.988	0.435	17.463	0.849	20.908	1.465	24.301	2.321	27.612	3.450	30.804	4.883	33.828	6.642		**30**
25	3.500	0.008	6.999	0.065	10.496	0.220	13.982	0.522	17.446	1.019	20.867	1.756	24.213	2.778	27.443	4.122	30.502	5.818	33.323	7.885		**25**
23	3.500	0.009	6.999	0.071	10.495	0.240	13.979	0.568	17.437	1.107	20.843	1.907	24.162	3.015	27.343	4.469	30.324	6.298	33.027	8.516		**23**
20	3.500	0.010	6.999	0.082	10.493	0.276	13.973	0.652	17.416	1.272	20.793	2.189	24.053	3.456	27.135	5.111	29.954	7.179	32.414	9.663		**20**
15	3.500	0.014	6.998	0.109	10.488	0.367	13.951	0.869	17.352	1.691	20.633	2.903	23.711	4.561	26.479	6.696	28.801	9.307	30.527	12.344		**15**
14	3.500	0.015	6.998	0.117	10.487	0.393	13.944	0.931	17.330	1.810	20.579	3.105	23.597	4.870	26.260	7.132	28.420	9.878	29.913	13.034		**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_C	Length of Transition Curve to Chord Points in Metre										L. T.	S. T	L. C.	Θ_s	s	K	R_C
	4.0	8.0	12.0	16.0	20.0	24.0	28.0	32.0	36 0	40 0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 5	0 0 22	0 0 49	0 1 28	0 2 17	0 3 18	0 4 29	0 5 52	0 7 25	0 9 10	26.667	13.333	40.000	0 27 30	0.026	20.000	**2500**
2200	0 0 6	0 0 25	0 0 56	0 1 40	0 2 36	0 3 45	0 5 6	0 6 40	0 8 26	0 10 25	26.667	13.333	40.000	0 31 15	0.030	20.000	**2200**
2000	0 0 6	0 0 27	0 1 1	0 1 50	0 2 51	0 4 7	0 5 36	0 7 20	0 9 16	0 11 27	26.667	13.333	40.000	0 34 22	0.033	20.000	**2000**
1800	0 0 7	0 0 30	0 1 8	0 2 2	0 3 10	0 4 35	0 6 14	0 8 8	0 10 18	0 12 43	26.667	13.333	40.000	0 38 11	0.037	20.000	**1800**
1500	0 0 9	0 0 36	0 1 22	0 2 26	0 3 49	0 5 30	0 7 29	0 9 46	0 12 22	0 15 16	26.667	13.334	40.000	0 45 50	0.044	20.000	**1500**
1200	0 0 11	0 0 45	0 1 43	0 3 3	0 4 46	0 6 52	0 9 21	0 12 13	0 15 28	0 19 5	26.667	13.334	40.000	0 57 17	0.055	20.000	**1200**
1000	0 0 13	0 0 55	0 2 3	0 3 40	0 5 45	0 8 15	0 11 13	0 14 40	0 18 33	0 22 55	26.667	13.334	39.999	1 8 45	0.067	20.000	**1000**
900	0 0 15	0 1 1	0 2 17	0 4 4	0 6 21	0 9 10	0 12 28	0 16 17	0 20 37	0 25 27	26.667	13.334	39.999	1 16 23	0.074	20.000	**900**
800	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	26.668	13.334	39.999	1 25 56	0.083	20.000	**800**
700	0 0 19	0 1 18	0 2 56	0 5 14	0 8 11	0 11 47	0 16 2	0 20 57	0 26 31	0 32 44	26.668	13.334	39.999	1 38 13	0.095	19.999	**700**
600	0 0 22	0 1 31	0 3 26	0 6 6	0 9 32	0 13 45	0 18 42	0 24 26	0 30 56	0 38 11	26.668	13.335	39.998	1 54 35	0.111	19.999	**600**
500	0 0 27	0 1 50	0 4 7	0 7 20	0 11 27	0 16 30	0 22 27	0 29 20	0 37 7	0 45 50	26.669	13.335	39.997	2 17 30	0.133	19.999	**500**
400	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17	26.670	13.337	39.996	2 51 53	0.167	19.998	**400**
360	0 0 38	0 2 32	0 5 43	0 10 11	0 15 54	0 22 55	0 31 11	0 40 44	0 51 33	1 3 39	26.671	13.337	39.995	3 10 59	0.185	19.998	**360**
350	0 0 39	0 2 37	0 5 53	0 10 28	0 16 22	0 23 34	0 32 5	0 41 54	0 53 2	1 5 28	26.671	13.337	39.994	3 16 26	0.190	19.998	**350**
300	0 0 45	0 3 3	0 6 52	0 12 13	0 19 5	0 27 30	0 37 25	0 48 53	1 1 52	1 16 23	26.673	13.339	39.992	3 49 10	0.222	19.997	**300**
250	0 0 55	0 3 40	0 8 15	0 14 40	0 22 55	0 33 0	0 44 55	0 58 40	1 14 15	1 31 40	26.676	13.341	39.989	4 35 1	0.267	19.996	**250**
230	0 0 59	0 3 59	0 8 58	0 15 56	0 24 54	0 35 52	0 48 49	1 3 46	1 20 42	1 39 38	26.677	13.343	39.987	4 58 56	0.290	19.995	**230**
200	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34	26.681	13.346	39.982	5 43 46	0.333	19.993	**200**
170	0 1 20	0 5 23	0 12 7	0 21 34	0 33 42	0 48 31	1 6 3	1 26 16	1 49 11	2 14 47	26.686	13.351	39.975	6 44 26	0.392	19.991	**170**
155	0 1 28	0 5 54	0 13 18	0 23 39	0 36 57	0 53 13	1 12 26	1 34 37	1 59 45	2 27 50	26.690	13.355	39.970	7 23 34	0.430	19.989	**155**
125	0 1 50	0 7 20	0 16 30	0 29 20	0 45 50	1 6 0	1 29 50	1 57 19	2 28 29	3 3 18	26.702	13.366	39.954	9 10 2	0.533	19.983	**125**
100	0 2 17	0 9 10	0 20 37	0 36 40	0 57 17	1 22 30	1 52 17	2 26 39	3 5 35	3 49 6	26.722	13.384	39.929	11 27 32	0.666	19.973	**100**
90	0 2 32	0 10 11	0 22 55	0 40 44	1 3 39	1 31 40	2 4 45	2 42 56	3 26 12	4 14 32	26.736	13.396	39.912	12 43 56	0.739	19.967	**90**
80	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	26.754	13.413	39.888	14 19 26	0.831	19.958	**80**
70	0 3 16	0 13 5	0 29 27	0 52 23	1 21 50	1 57 51	2 40 24	3 29 28	4 25 4	5 27 10	26.780	13.438	39.854	16 22 12	0.950	19.944	**70**
60	0 3 49	0 15 16	0 34 22	1 1 6	1 35 29	2 17 29	3 7 7	4 4 22	5 9 12	6 21 36	26.821	13.476	39.801	19 5 54	1.107	19.924	**60**
55	0 4 10	0 16 40	0 37 30	1 6 40	1 44 10	2 29 59	3 24 7	4 26 33	5 37 16	6 56 13	26.851	13.504	39.762	20 50 5	1.206	19.909	**55**
50	0 4 35	0 18 20	0 41 15	1 13 20	1 54 34	2 44 58	3 44 31	4 53 11	6 10 56	7 37 44	26.889	13.540	39.712	22 55 6	1.326	19.889	**50**
45	0 5 5	0 20 22	0 45 50	1 21 29	2 7 18	3 3 18	4 9 27	5 25 43	6 52 4	8 28 26	26.941	13.589	39.643	25 27 53	1.471	19.862	**45**
40	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	27.013	13.659	39.546	28 38 52	1.652	19.823	**40**
35	0 6 32	0 26 11	0 58 55	1 44 45	2 43 40	3 55 38	5 20 38	6 58 36	8 49 25	10 52 59	27.118	13.762	39.403	32 44 25	1.883	19.765	**35**
33	0 6 56	0 27 46	1 2 30	1 51 6	2 53 35	4 9 55	5 40 2	7 23 54	9 21 23	11 32 18	27.174	13.818	39.327	34 43 29	1.994	19.733	**33**
30	0 7 38	0 30 33	1 8 45	2 2 13	3 10 56	4 34 53	6 13 59	8 8 10	10 17 15	12 41 2	27.279	13.925	39.180	38 11 49	2.187	19.671	**30**
25	0 9 10	0 36 40	1 22 30	2 26 39	3 49 6	5 29 47	7 28 36	9 45 23	12 19 53	15 11 41	27.544	14.203	38.802	45 50 11	2.607	19.506	**25**
23	0 9 57	0 39 51	1 29 40	2 39 24	4 9 0	5 58 25	8 7 30	10 36 2	13 23 41	16 29 57	27.702	14.375	38.572	49 49 20	2.822	19.402	**23**
20	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58	28.031	14.749	38 079	57 17 44	3.217	19.171	**20**
15	0 15 16	1 1 6	2 17 29	4 4 22	6 21 36	9 8 57	12 25 55	16 11 42	20 25 1	25 3 52	29.103	16.096	36.420	76 23 39	4.173	18.310	**15**
14	0 16 22	1 5 28	2 27 18	4 21 48	6 48 48	9 48 0	13 18 46	17 20 7	21 50 27	26 47 18	29.482	16.613	35.833	81 51 4	4.429	17.978	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=40 metre

R_c	Length of Transition Curve to Chord Points in Metre																		R_c		
	4.0		8.0		12.0		16.0		20.0		24.0		28.0		30.0		32.0		34.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	4.000	0.000	8.000	0.001	12.000	0.003	16.000	0.007	20.000	0.013	24.000	0.023	28.000	0.037	32.000	0.055	36.000	0.078	40.000	0.107	**2500**
2200	4.000	0.000	8.000	0.001	12.000	0.003	16.000	0.008	20.000	0.015	24.000	0.026	28.000	0.042	32.000	0.062	36.000	0.088	40.000	0.121	**2200**
2000	4.000	0.000	8.000	0.001	12.000	0.004	16.000	0.009	20.000	0.017	24.000	0.029	28.000	0.046	32.000	0.068	36.000	0.097	40.000	0.133	**2000**
1800	4.000	0.000	8.000	0.001	12.000	0.004	16.000	0.009	20.000	0.019	24.000	0.032	28.000	0.051	32.000	0.076	36.000	0.108	40.000	0.148	**1800**
1500	4.000	0.000	8.000	0.001	12.000	0.005	16.000	0.011	20.000	0.022	24.000	0.038	28.000	0.061	32.000	0.091	36.000	0.130	39.999	0.178	**1500**
1200	4.000	0.000	8.000	0.002	12.000	0.006	16.000	0.014	20.000	0.028	24.000	0.048	28.000	0.076	32.000	0.114	35.999	0.162	39.999	0.222	**1200**
1000	4.000	0.000	8.000	0.002	12.000	0.007	16.000	0.017	20.000	0.033	24.000	0.058	28.000	0.091	31.999	0.137	35.999	0.194	39.998	0.267	**1000**
900	4.000	0.000	8.000	0.002	12.000	0.008	16.000	0.019	20.000	0.037	24.000	0.064	28.000	0.102	31.999	0.152	35.999	0.216	39.998	0.296	**900**
800	4.000	0.000	8.000	0.003	12.000	0.009	16.000	0.021	20.000	0.042	24.000	0.072	28.000	0.114	31.999	0.171	35.999	0.243	39.997	0.333	**800**
700	4.000	0.000	8.000	0.003	12.000	0.010	16.000	0.024	20.000	0.048	24.000	0.082	27.999	0.131	31.999	0.195	35.998	0.278	39.997	0.381	**700**
600	4.000	0.000	8.000	0.004	12.000	0.012	16.000	0.028	20.000	0.056	24.000	0.096	27.999	0.152	31.999	0.228	35.997	0.324	39.996	0.444	**600**
500	4.000	0.001	8.000	0.004	12.000	0.014	16.000	0.034	20.000	0.067	23.999	0.115	27.999	0.183	31.998	0.273	35.996	0.389	39.994	0.533	**500**
400	4.000	0.001	8.000	0.005	12.000	0.018	16.000	0.043	20.000	0.083	23.999	0.144	27.998	0.229	31.997	0.341	35.994	0.486	39.990	0.667	**400**
360	4.000	0.001	8.000	0.006	12.000	0.020	16.000	0.047	20.000	0.093	23.999	0.160	27.998	0.254	31.996	0.379	35.993	0.540	39.988	0.741	**360**
350	4.000	0.001	8.000	0.006	12.000	0.021	16.000	0.049	20.000	0.095	23.999	0.165	27.998	0.261	31.996	0.390	35.992	0.555	39.987	0.762	**350**
300	4.000	0.001	8.000	0.007	12.000	0.024	16.000	0.057	19.999	0.111	23.999	0.192	27.997	0.305	31.994	0.455	35.990	0.648	39.982	0.889	**300**
250	4.000	0.001	8.000	0.009	12.000	0.029	16.000	0.068	19.999	0.133	23.998	0.230	27.996	0.366	31.992	0.546	35.985	0.777	39.974	1.066	**250**
230	4.000	0.001	8.000	0.009	12.000	0.031	16.000	0.074	19.999	0.145	23.998	0.250	27.995	0.398	31.990	0.593	35.982	0.845	39.970	1.159	**230**
200	4.000	0.001	8.000	0.011	12.000	0.036	16.000	0.085	19.999	0.167	23.997	0.288	27.993	0.457	31.987	0.682	35.976	0.972	39.960	1.332	**200**
170	4.000	0.002	8.000	0.013	12.000	0.042	15.999	0.100	19.998	0.196	23.996	0.339	27.991	0.538	31.982	0.803	35.967	1.143	39.945	1.567	**170**
155	4.000	0.002	8.000	0.014	12.000	0.046	15.999	0.110	19.998	0.215	23.995	0.372	27.989	0.590	31.978	0.880	35.961	1.253	39.933	1.718	**155**
125	4.000	0.002	8.000	0.017	12.000	0.058	15.999	0.137	19.997	0.267	23.992	0.461	27.983	0.731	31.966	1.091	35.940	1.553	39.898	2.129	**125**
100	4.000	0.003	8.000	0.021	12.000	0.072	15.998	0.171	19.995	0.333	23.988	0.576	27.973	0.914	31.948	1.364	35.906	1.940	39.840	2.659	**100**
90	4.000	0.003	8.000	0.024	12.000	0.080	15.998	0.190	19.994	0.370	23.985	0.640	27.967	1.015	31.935	1.515	35.884	2.155	39.803	2.953	**90**
80	4.000	0.003	8.000	0.027	11.999	0.090	15.997	0.213	19.992	0.417	23.981	0.720	27.958	1.142	31.918	1.704	35.853	2.423	39.751	3.318	**80**
70	4.000	0.004	8.000	0.030	11.999	0.103	15.997	0.244	19.990	0.476	23.975	0.822	27.945	1.305	31.893	1.946	35.808	2.767	39.675	3.787	**70**
60	4.000	0.004	8.000	0.036	11.999	0.120	15.995	0.284	19.986	0.555	23.965	0.959	27.925	1.522	31.855	2.268	35.738	3.223	39.558	4.409	**60**
55	4.000	0.005	8.000	0.039	11.999	0.131	15.995	0.310	19.983	0.606	23.959	1.046	27.911	1.659	31.827	2.473	35.689	3.513	39.474	4.803	**55**
50	4.000	0.005	8.000	0.043	11.998	0.144	15.993	0.341	19.980	0.666	23.950	1.150	27.893	1.824	31.791	2.718	35.624	3.859	39.365	5.273	**50**
45	4.000	0.006	8.000	0.047	11.998	0.160	15.992	0.379	19.975	0.740	23.939	1.278	27.867	2.026	31.742	3.017	35.536	4.280	39.217	5.843	**45**
40	4.000	0.007	8.000	0.053	11.998	0.180	15.990	0.426	19.969	0.832	23.922	1.437	27.832	2.277	31.674	3.388	35.414	4.803	39.012	6.549	**40**
35	4.000	0.008	8.000	0.061	11.997	0.206	15.987	0.487	19.959	0.951	23.899	1.641	27.781	2.599	31.575	3.864	35.236	5.470	38.713	7.443	**35**
33	4.000	0.008	8.000	0.065	11.996	0.218	15.985	0.517	19.954	1.008	23.886	1.740	27.754	2.754	31.522	4.093	35.142	5.790	38.556	7.871	**33**
30	4.000	0.009	7.999	0.071	11.996	0.240	15.982	0.568	19.945	1.109	23.862	1.912	27.703	3.026	31.422	4.492	34.964	6.346	38.258	8.611	**30**
25	4.000	0.011	7.999	0.085	11.994	0.288	15.974	0.682	19.920	1.330	23.802	2.290	27.573	3.619	31.171	5.360	34.517	7.546	37.515	10.189	**25**
23	4.000	0.012	7.999	0.093	11.993	0.313	15.969	0.741	19.906	1.444	23.766	2.487	27.496	3.926	31.023	5.806	34.255	8.157	37.079	10.983	**23**
20	4.000	0.013	7.999	0.107	11.990	0.360	15.959	0.852	19.875	1.659	23.691	2.853	27.335	4.495	30.714	6.630	33.709	9.274	36.181	12.411	**20**
15	4.000	0.018	7.998	0.142	11.983	0.480	15.927	1.134	19.779	2.205	23.453	3.777	26.828	5.914	29.747	8.640	32.022	11.920	33.450	15.644	**15**
14	4.000	0.019	7.997	0.152	11.980	0.514	15.917	1.215	19.746	2.359	23.373	4.037	26.659	6.308	29.427	9.185	31.469	12.613	32.572	16.445	**14**

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls= 45 metre

R_C	Length of Transition Curve to Chord Points in Metre										L.T.	S.T.	L.C	Θ_s	s	K	R_C
	4.5	9.0	13.5	18.0	22.5	27.0	31.5	36.0	40.5	45.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 6	0 0 24	0 0 55	0 1 39	0 2 34	0 3 42	0 5 3	0 6 36	0 8 21	0 10 18	30.000	15.000	45.000	0 30 56	0.034	22.500	**2500**
2200	0 0 7	0 0 28	0 1 3	0 1 52	0 2 55	0 4 13	0 5 44	0 7 30	0 9 29	0 11 43	30.000	15.000	45.000	0 35 9	0.038	22.500	**2200**
2000	0 0 7	0 0 30	0 1 9	0 2 3	0 3 13	0 4 38	0 6 19	0 8 15	0 10 26	0 12 53	30.000	15 000	45,000	0 38 40	0.042	22.500	**2000**
1800	0 0 8	0 0 34	0 1 17	0 2 17	0 3 34	0 5 9	0 7 1	0 9 10	0 11 36	0 14 19	30.000	15.000	45.000	0 42 58	0.047	22.500	**1800**
1500	0 0 10	0 0 41	0 1 32	0 2 45	0 4 17	0 6 11	0 8 25	0 11 0	0 13 55	0 17 11	30.000	15.000	45.000	0 51 33	0.056	22.500	**1500**
1200	0 0 12	0 0 51	0 1 56	0 3 26	0 5 22	0 7 44	0 10 31	0 13 45	0 17 24	0 21 29	30.001	15.001	44.999	1 4 27	0 070	22.500	**1200**
1000	0 0 15	0 1 1	0 2 19	0 4 7	0 6 26	0 9 16	0 12 38	0 16 30	0 20 53	0 25 46	30.001	15.001	44.999	1 17 20	0.084	22.500	**1000**
900	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	30.001	15.001	44.999	1 25 56	0.094	22.500	**900**
800	0 0 19	0 1 17	0 2 54	0 5 9	0 8 3	0 11 36	0 15 47	0 20 37	0 26 6	0 32 13	30.001	15.001	44.998	1 36 41	0.105	22.499	**800**
700	0 0 22	0 1 28	0 3 18	0 5 53	0 9 12	0 13 15	0 18 2	0 23 34	0 29 50	0 36 49	30.002	15.001	44.998	1 50 29	0.120	22.499	**700**
600	0 0 25	0 1 43	0 3 52	0 6 52	0 10 44	0 15 28	0 21 3	0 27 30	0 34 48	0 42 58	30.002	15.002	44.997	2 8 54	0.141	22.499	**600**
500	0 0 30	0 2 3	0 4 38	0 8 15	0 12 53	0 18 33	0 25 16	0 33 0	0 41 46	0 51 33	30.003	15.003	44.996	2 34 41	0.169	22.498	**500**
400	0 0 38	0 2 34	0 5 48	0 10 18	0 16 6	0 23 12	0 31 35	0 41 15	0 52 12	1 4 27	30.005	15.005	44.994	3 13 22	0.211	22.498	**400**
360	0 0 42	0 2 51	0 6 26	0 11 27	0 17 54	0 25 46	0 35 5	0 45 50	0 58 0	1 11 37	30.006	15.006	44.992	3 34 51	0.234	22.497	**360**
350	0 0 44	0 2 56	0 6 37	0 11 47	0 18 24	0 26 31	0 36 5	0 47 8	0 59 40	1 13 39	30.006	15.006	44.992	3 40 59	0.241	22.497	**350**
300	0 0 51	0 3 26	0 7 44	0 13 45	0 21 29	0 30 56	0 42 6	0 55 0	1 9 36	1 25 56	30.009	15.008	44.989	4 17 49	0.281	22.496	**300**
250	0 1 1	0 4 7	0 9 16	0 16 30	0 25 46	0 37 7	0 50 32	1 6 0	1 23 32	1 43 7	30.013	15.012	44.984	5 9 23	0.337	22.494	**250**
230	0 1 7	0 4 29	0 10 5	0 17 56	0 28 1	0 40 21	0 54 55	1 11 44	1 30 47	1 52 5	30.015	15.014	44.981	5 36 18	0.367	22.493	**230**
200	0 1 17	0 5 9	0 11 36	0 20 37	0 32 13	0 46 24	1 3 10	1 22 30	1 44 24	2 8 54	30.020	15.018	44.975	6 26 44	0.422	22.490	**200**
170	0 1 30	0 6 3	0 13 38	0 24 15	0 37 54	0 54 35	1 14 18	1 37 3	2 2 50	2 31 38	30.028	15.025	44.965	7 34 59	0.496	22.487	**170**
155	0 1 39	0 6 39	0 14 58	0 26 36	0 41 35	0 59 52	1 21 30	1 46 27	2 14 43	2 46 18	30.033	15.030	44.958	8 19 1	0.544	22.484	**155**
125	0 2 3	0 8 15	0 18 33	0 33 0	0 51 33	1 14 15	1 41 3	2 11 59	2 47 2	3 26 12	30.051	15.046	44.935	10 18 47	0 674	22.476	**125**
100	0 2 34	0 10 18	0 23 12	0 41 15	1 4 27	1 32 48	2 6 19	2 44 58	3 28 47	4 17 43	30.079	15.073	44.898	12 53 29	0.842	22.462	**100**
90	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	30.098	15.090	44.874	14 19 26	0.935	22.452	**90**
80	0 3 13	0 12 53	0 29 0	0 51 33	1 20 34	1 56 0	2 37 53	3 26 12	4 20 56	5 22 4	30.124	15.114	44.841	16 6 52	1.052	22.439	**80**
70	0 3 40	0 14 43	0 33 8	0 58 55	1 32 4	2 12 35	3 0 26	3 55 38	4 58 10	6 8 0	30.162	15.149	44.792	18 24 59	1.201	22.421	**70**
60	0 4 17	0 17 11	0 38 40	1 8 45	1 47 25	2 34 40	3 30 30	4 34 53	5 47 47	7 9 12	30.220	15.204	44.715	21 29 9	1.399	22.391	**60**
55	0 4 41	0 18 45	0 42 11	1 15 0	1 57 11	2 48 43	3 49 37	4 59 50	6 19 21	7 48 7	30.261	15.243	44 660	23 26 21	1.525	22 369	**55**
50	0 5 9	0 20 37	0 46 24	1 22 30	2 8 54	3 5 35	4 12 34	5 29 47	6 57 12	8 34 46	30.316	15.295	44.588	25 46 59	1.675	22.340	**50**
45	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	30.390	15.367	44.489	28 38 52	1.858	22.301	**45**
40	0 6 26	0 25 46	0 58 0	1 43 7	2 41 7	3 51 58	5 15 38	6 52 4	8 41 11	10 42 50	30.492	15.467	44.350	32 13 44	2.086	22.244	**40**
35	0 7 21	0 29 27	1 6 17	1 57 51	3 4 7	4 25 4	6 0 39	7 50 47	9 55 18	12 14 3	30.641	15.617	44.144	36 49 58	2.375	22.158	**35**
33	0 7 48	0 31 15	1 10 18	2 4 59	3 15 16	4 41 7	6 22 28	8 19 13	10 31 12	12 58 11	30.720	15.697	44.034	39 3 55	2.515	22.111	**33**
30	0 8 35	0 34 22	1 17 20	2 17 29	3 34 47	5 9 12	7 0 38	9 8 57	11 33 56	14 15 17	30.869	15.853	43.822	42 58 18	2.757	22.020	**30**
25	0 10 18	0 41 15	1 32 48	2 44 58	4 17 43	6 10 56	8 24 30	10 58 10	13 51 33	17 4 6	31.246	16.262	43.273	51 33 58	3.279	21.772	**25**
23	0 11 12	0 44 50	1 40 53	2 59 19	4 40 6	6 43 8	9 8 13	11 55 2	15 3 6	18 31 42	31.470	16.516	42.938	56 3 0	3.546	21.614	**23**
20	0 12 53	0 51 33	1 56 0	3 26 12	5 22 4	7 43 26	10 30 2	13 41 23	17 16 43	21 14 54	31.941	17.079	42.217	64 27 28	4.033	21.259	**20**
15	0 17 11	1 8 45	2 34 40	4 54 55	7 9 12	10 17 15	13 58 20	18 11 18	22 54 15	28 4 18	33.518	19.181	39.778	85 56 37	5.194	19.913	**15**
14																	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

L_S = 45 metre

R_c	Length of Transition Curve to Chord Points in Metre																		R_c		
	4.5		9.0		13.5		18.0		22.5		27.0		31.5		36.0		40.5		45.0		
metre	X 1	Y 1	X 2	Y 2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	4.500	0.000	9.000	0.001	13.500	0.004	18.000	0.009	22.500	0.017	27.000	0.029	31.500	0.046	36.000	0.069	40.500	0.098	45.000	0.135	**2500**
2200	4.500	0.000	9.000	0.001	13.500	0.004	18.000	0.010	22.500	0.019	27.000	0.033	31.500	0.053	36.000	0.079	40.500	0.112	45.000	0.153	**2200**
2000	4.500	0.000	9.000	0.001	13.500	0.005	18.000	0.011	22.500	0.021	27.000	0.036	31.500	0.058	36.000	0.086	40.500	0.123	44.999	0.169	**2000**
1800	4.500	0.000	9.000	0.002	13.500	0.005	18.000	0.012	22.500	0.023	27.000	0.040	31.500	0.064	36.000	0.096	40.500	0.137	44.999	0.187	**1800**
1500	4.500	0.000	9.000	0.002	13.500	0.006	18.000	0.014	22.500	0.028	27.000	0.049	31.500	0.077	36.000	0.115	40.499	0.164	44.999	0.225	**1500**
1200	4.500	0.000	9.000	0.002	13.500	0.008	18.000	0.018	22.500	0.035	27.000	0.061	31.500	0.096	35.999	0.144	40.499	0.205	44.998	0.281	**1200**
1000	4.500	0.000	9.000	0.003	13.500	0.009	18.000	0.022	22.500	0.042	27.000	0.073	31.500	0.116	35.999	0.173	40.499	0.246	44.998	0.337	**1000**
900	4.500	0.000	9.000	0.003	13.500	0.010	18.000	0.024	22.500	0.047	27.000	0.081	31.500	0.129	35.999	0.192	40.498	0.273	44.997	0.375	**900**
800	4.500	0.000	9.000	0.003	13.500	0.011	18.000	0.027	22.500	0.053	27.000	0.091	31.499	0.145	35.999	0.216	40.498	0.308	44.996	0.422	**800**
700	4.500	0.000	9.000	0.004	13.500	0.013	18.000	0.031	22.500	0.060	27.000	0.104	31.499	0.165	35.998	0.247	40.497	0.351	44.995	0.482	**700**
600	4.500	0.001	9.000	0.005	13.500	0.015	18.000	0.036	22.500	0.070	27.000	0.121	31.499	0.193	35.998	0.288	40.496	0.410	44.994	0.562	**600**
500	4.500	0.001	9.000	0.005	13.500	0.018	18.000	0.043	22.500	0.084	26.999	0.146	31.498	0.232	35.997	0.346	40.495	0.492	44.991	0.675	**500**
400	4.500	0.001	9.000	0.007	13.500	0.023	18.000	0.054	22.500	0.105	26.999	0.182	31.498	0.289	35.995	0.432	40.492	0.615	44.986	0.844	**400**
360	4.500	0.001	9.000	0.007	13.500	0.025	18.000	0.060	22.499	0.117	26.999	0.202	31.497	0.322	35.994	0.480	40.490	0.683	44.982	0.937	**360**
350	4.500	0.001	9.000	0.008	13.500	0.026	18.000	0.062	22.499	0.121	26.999	0.208	31.497	0.331	35.994	0.494	40.489	0.703	44.981	0.964	**350**
300	4.500	0.001	9.000	0.009	13.500	0.030	18.000	0.072	22.499	0.141	26.998	0.243	31.496	0.386	35.992	0.576	40.485	0.820	44.975	1.125	**300**
250	4.500	0.001	9.000	0.011	13.500	0.036	18.000	0.086	22.499	0.169	26.997	0.292	31.494	0.463	35.988	0.691	40.478	0.984	44.964	1.349	**250**
230	4.500	0.001	9.000	0.012	13.500	0.040	18.000	0.094	22.499	0.183	26.997	0.317	31.493	0.503	35.986	0.751	40.475	1.069	44.957	1.466	**230**
200	4.500	0.002	9.000	0.013	13.500	0.046	17.999	0.108	22.498	0.211	26.996	0.364	31.490	0.579	35.981	0.864	40.466	1.229	44.943	1.686	**200**
170	4.500	0.002	9.000	0.016	13.500	0.054	17.999	0.127	22.498	0.248	26.994	0.429	31.487	0.681	35.974	1.016	40.453	1.446	44.921	1.983	**170**
155	4.500	0.002	9.000	0.017	13.500	0.059	17.999	0.139	22.497	0.272	26.993	0.470	31.484	0.747	35.969	1.114	40.444	1.586	44.905	2.174	**155**
125	4.500	0.003	9.000	0.022	13.500	0.073	17.999	0.173	22.495	0.337	26.989	0.583	31.476	0.926	35.952	1.381	40.414	1.965	44.854	2.694	**125**
100	4.500	0.003	9.000	0.027	13.499	0.091	17.998	0.216	22.493	0.422	26.982	0.729	31.462	1.157	35.925	1.725	40.366	2.455	44.773	3.363	**100**
90	4.500	0.004	9.000	0.030	13.499	0.101	17.997	0.240	22.491	0.469	26.978	0.810	31.453	1.285	35.908	1.916	40.334	2.726	44.720	3.733	**90**
80	4.500	0.004	9.000	0.034	13.499	0.114	17.996	0.270	22.489	0.527	26.972	0.911	31.440	1.445	35.884	2.155	40.290	3.064	44.645	4.195	**80**
70	4.500	0.005	9.000	0.039	13.499	0.130	17.995	0.309	22.485	0.602	26.964	1.040	31.422	1.651	35.848	2.461	40.226	3.498	44.537	4.786	**70**
60	4.500	0.006	9.000	0.045	13.498	0.152	17.994	0.360	22.480	0.703	26.951	1.213	31.394	1.925	35.793	2.868	40.128	4.074	44.371	5.569	**60**
55	4.500	0.006	9.000	0.049	13.498	0.166	17.992	0.393	22.476	0.766	26.941	1.323	31.374	2.099	35.754	3.126	40.058	4.438	44.253	6.063	**55**
50	4.500	0.007	9.000	0.054	13.498	0.182	17.991	0.432	22.472	0.843	26.929	1.455	31.347	2.307	35.703	3.436	39.965	4.874	44.097	6.653	**50**
45	4.500	0.007	9.000	0.060	13.497	0.202	17.988	0.480	22.465	0.936	26.913	1.616	31.311	2.561	35.633	3.812	39.841	5.404	43.888	7.367	**45**
40	4.500	0.008	9.000	0.067	13.497	0.228	17.985	0.540	22.456	1.053	26.889	1.817	31.262	2.878	35.536	4.280	39.667	6.060	43.597	8.249	**40**
35	4.500	0.010	8.999	0.077	13.495	0.260	17.981	0.617	22.442	1.203	26.856	2.075	31.189	3.284	35.395	4.878	39.416	6.895	43.176	9.362	**35**
33	4.500	0.010	8.999	0.082	13.495	0.276	17.979	0.654	22.435	1.276	26.838	2.200	31.150	3.480	35.321	5.166	39.282	7.295	42.953	9.893	**33**
30	4.500	0.011	8.999	0.090	13.494	0.304	17.974	0.719	22.421	1.403	26.804	2.417	31.077	3.822	35.179	5.666	39.031	7.988	42.534	10.806	**30**
25	4.500	0.013	8.999	0.108	13.491	0.364	17.963	0.863	22.386	1.681	26.718	2.894	30.893	4.567	34.824	6.750	38.400	9.474	41.489	12.739	**25**
23	4.500	0.015	8.999	0.117	13.490	0.396	17.956	0.937	22.366	1.826	26.667	3.142	30.784	4.951	34.614	7.305	38.030	10.227	40.880	13.701	**23**
20	4.500	0.017	8.998	0.135	13.486	0.455	17.942	1.078	22.323	2.097	26.560	3.603	30.556	5.664	34.178	8.325	37.264	11.591	39.629	15.410	**20**
15	4.500	0.022	8.997	0.180	13.475	0.607	17.897	1.434	22.186	2.784	26.223	4.760	29.840	7.425	32.821	10.784	34.916	14.752	35.875	19.133	**15**
14																					**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls 50 = metre

R_C	Length of Transition Curve to Chord Points in Metre										L_T.	S.T.	L.C.	Θ_s	s	K	R_D
	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 6	0 0 27	0 1 1	0 1 50	0 2 51	0 4 7	0 5 36	0 7 20	0 9 16	0 11 27	33.333	16.667	50.000	0 34 22	0.041	25.000	**2500**
2200	0 0 7	0 0 31	0 1 10	0 2 5	0 3 15	0 4 41	0 6 22	0 8 20	0 10 32	0 13 1	33.334	16.667	50.000	0 39 3	0.047	25.000	**2200**
2000	0 0 8	0 0 34	0 1 17	0 2 17	0 3 34	0 5 9	0 7 1	0 9 10	0 11 36	0 14 19	33.334	16.667	50.000	0 42 58	0.052	25.000	**2000**
1800	0 0 9	0 0 38	0 1 25	0 2 32	0 3 58	0 5 43	0 7 47	0 10 11	0 12 53	0 15 54	33.334	16.667	50.000	0 47 44	0.058	25.000	**1800**
1500	0 0 11	0 0 45	0 1 43	0 3 3	0 4 46	0 6 52	0 9 21	0 12 13	0 15 28	0 19 5	33.334	16.667	49.999	0 57 17	0.069	25.000	**1500**
1200	0 0 14	0 0 57	0 2 8	0 3 49	0 5 58	0 8 35	0 11 41	0 15 16	0 19 20	0 23 52	33.334	16.667	49.999	1 11 37	0.087	25.000	**1200**
1000	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	33.334	16.668	49.999	1 25 56	0.104	24.999	**1000**
900	0 0 19	0 1 16	0 2 51	0 5 5	0 7 57	0 11 27	0 15 35	0 20 22	0 25 46	0 31 49	33.335	16.668	49.998	1 35 29	0.116	24.999	**900**
800	0 0 21	0 1 25	0 3 13	0 5 43	0 8 57	0 12 53	0 17 32	0 22 55	0 29 0	0 35 48	33.335	16.668	49.998	1 47 25	0.130	24.999	**800**
700	0 0 24	0 1 38	0 3 40	0 6 32	0 10 13	0 14 43	0 20 3	0 26 11	0 33 8	0 40 55	33.336	16.669	49.997	2 2 46	0.149	24.999	**700**
600	0 0 28	0 1 54	0 4 17	0 7 38	0 11 56	0 17 11	0 23 23	0 30 33	0 38 40	0 47 44	33.336	16.669	49.996	2 23 14	0.174	24.999	**600**
500	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17	33.338	16.671	49.994	2 51 53	0.208	24.998	**500**
400	0 0 42	0 2 51	0 6 26	0 11 27	0 17 54	0 25 46	0 35 5	0 45 50	0 58 0	1 11 37	33.340	16.673	49.991	3 34 51	0.260	24.997	**400**
360	0 0 47	0 3 10	0 7 9	0 12 43	0 19 53	0 28 38	0 38 59	0 50 55	1 4 27	1 19 34	33.342	16.674	49.989	3 58 43	0.289	24.996	**360**
350	0 0 49	0 3 16	0 7 21	0 13 5	0 20 27	0 29 27	0 40 6	0 52 23	1 6 17	1 21 50	33.342	16.675	49.989	4 5 33	0.298	24.996	**350**
300	0 0 57	0 3 49	0 8 35	0 15 16	0 23 52	0 34 22	0 46 47	1 1 6	1 17 20	1 35 29	33.345	16.678	49.985	4 46 28	0.347	24.994	**300**
250	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34	33.351	16.683	49.978	5 43 46	0.417	24.992	**250**
230	0 1 14	0 4 58	0 11 12	0 19 55	0 31 8	0 44 50	1 1 1	1 19 42	1 40 53	2 4 32	33.354	16 685	49 974	6 13 40	0.453	24.990	**230**
200	0 1 25	0 5 43	0 12 53	0 22 55	0 35 48	0 51 33	1 10 11	1 31 40	1 56 0	2 23 13	33.361	16.692	49.965	7 9 43	0.521	24.987	**200**
170	0 1 41	0 6 44	0 15 9	0 26 57	0 42 7	1 0 39	1 22 34	1 47 50	2 16 28	2 48 29	33.371	16.701	49.952	8 25 33	0.612	24.982	**170**
155	0 1 50	0 7 23	0 16 38	0 29 34	0 46 12	1 6 32	1 30 33	1 58 16	2 29 41	3 4 47	33.379	16.708	49.942	9 14 28	0.671	24.978	**155**
125	0 2 17	0 9 10	0 20 37	0 36 40	0 57 17	1 22 30	1 52 17	2 26 39	3 5 35	3 49 6	33.403	16 730	49.911	11 27 32	0.832	24.966	**125**
100	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	33.442	16 767	49.860	14 19 26	1.039	24.947	**100**
90	0 3 10	0 12 43	0 28 38	0 50 55	1 19 34	1 54 34	2 35 56	3 23 39	4 17 43	5 18 6	33.468	16.790	49.827	15 54 55	1.154	24.934	**90**
80	0 3 34	0 14 19	0 32 13	0 57 17	1 29 31	2 8 54	2 55 26	3 49 6	4 49 54	5 57 48	33.503	16.823	49.781	17 54 17	1.298	24.917	**80**
70	0 4 5	0 16 22	0 36 49	1 5 28	1 42 18	2 27 18	3 20 29	4 21 48	5 31 15	6 48 48	33.555	16.872	49.713	20 27 46	1.481	24 890	**70**
60	0 4 46	0 19 5	0 42 58	1 16 23	1 59 21	2 51 51	3 53 52	5 5 23	6 26 22	7 56 45	33.635	16.947	49.608	23 52 23	1.725	24.849	**60**
55	0 5 12	0 20 50	0 46 52	1 23 20	2 10 12	3 7 28	4 15 7	5 33 7	7 1 25	8 39 57	33.692	17.002	49.533	26 2 36	1.880	24 819	**55**
50	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	33.766	17.074	49.432	28 38 52	2.065	24.779	**50**
45	0 6 21	0 25 27	0 57 17	1 41 51	2 39 7	3 49 6	5 11 44	6 46 59	8 34 46	10 34 56	33.867	17.173	49.296	31 49 51	2.289	24.723	**45**
40	0 7 9	0 28 38	1 4 27	1 54 34	2 59 6	4 17 43	5 50 39	7 37 44	9 38 51	11 53 48	34.007	17.313	49.103	35 48 35	2.568	24.643	**40**
35	0 8 11	0 32 44	1 13 39	2 10 56	3 24 34	4 54 29	6 40 39	8 42 54	11 1 6	13 34 55	34.210	17.521	48.818	40 55 32	2.923	24 521	**35**
33	0 8 40	0 34 43	1 18 7	2 18 52	3 36 57	5 12 19	7 4 52	9 14 29	11 40 54	14 23 50	34.319	17.635	48.663	43 24 21	3.093	24.454	**33**
30	0 9 32	0 38 11	1 25 56	2 32 45	3 58 38	5 43 30	7 47 15	10 9 40	12 50 28	15 49 13	34.523	17.854	48.368	47 44 47	3.387	24.322	**30**
25	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58	35 039	18 436	47.599	57 17 44	4.021	23 963	**25**
23	0 12 27	0 49 49	1 52 5	3 19 14	5 11 11	7 27 49	10 8 50	13 13 51	16 42 9	20 32 44	35.346	18.802	47.129	62 16 41	4.343	23.733	**23**
20	0 14 19	0 57 17	2 8 54	3 49 6	5 57 48	8 34 46	11 39 37	15 11 41	19 9 55	23 32 42	36.000	19.622	46.114	71 37 11	4.927	23.208	**20**
15																	**15**
14																	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=50 metre

R_C	Length of Transition Curve to Chord Points in Metre																				R_C
	5.0		10.0		15.0		20.0		25.0		30.0		35.0		40.0		45.0		50.0		
	X 1	Y 1	X 2	Y 2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	
metre																					meter
2500	5.000	0.000	10.000	0.001	15.000	0.005	20.000	0.011	25.000	0.021	30.000	0.036	35.000	0.057	40.000	0.085	45.000	0.121	49.999	0.167	**2500**
2200	5.000	0.000	10.000	0.002	15.000	0.005	20.000	0.012	25.000	0.024	30.000	0.041	35.000	0.065	40.000	0.097	45.000	0.138	49.999	0.189	**2200**
2000	5.000	0.000	10.000	0.002	15.000	0.006	20.000	0.013	25.000	0.026	30.000	0.045	35.000	0.071	40.000	0 107	45.000	0.152	49 999	0.208	**2000**
1800	5.000	0.000	10.000	0.002	15.000	0.006	20.000	0.015	25.000	0.029	30.000	0.050	35.000	0.079	40.000	0.119	44.999	0.169	49.999	0.231	**1800**
1500	5.000	0.000	10.000	0.002	15.000	0.008	20.000	0.018	25.000	0.035	30.000	0.060	35.000	0.095	40.000	0.142	44.999	0.202	49.999	0.278	**1500**
1200	5.000	0.000	10.000	0.003	15.000	0.009	20.000	0.022	25.000	0.043	30.000	0.075	35.000	0.119	39.999	0.178	44.999	0.253	49.998	0.347	**1200**
1000	5.000	0.000	10.000	0.003	15.000	0.011	20.000	0.027	25.000	0.052	30.000	0.090	34.999	0.143	39.999	0.213	44.998	0.304	49.997	0.417	**1000**
900	5.000	0.000	10.000	0.004	15.000	0.012	20.000	0.030	25.000	0.058	30.000	0.100	34.999	0.159	39.999	0.237	44.998	0.337	49.996	0.463	**900**
800	5.000	0.001	10.000	0.004	15.000	0.014	20.000	0.033	25.000	0.065	30.000	0.112	34.999	0.179	39.998	0.267	44.997	0.380	49.995	0 521	**800**
700	5.000	0.001	10.000	0.005	15.000	0.016	20.000	0.038	25.000	0.074	30.000	0.129	34.999	0.204	39.998	0.305	44 996	0.434	49.994	0.595	**700**
600	5.000	0.001	10.000	0.006	15.000	0.019	20.000	0.044	25.000	0.087	29.999	0.150	34.999	0.238	39.997	0.356	44.995	0.506	49.991	0.694	**600**
500	5.000	0.001	10.000	0.007	15.000	0.022	20.000	0.053	25.000	0.104	29.999	0.180	34.998	0.286	39.996	0.427	44.993	0.607	49.988	0.833	**500**
400	5.000	0.001	10.000	0.008	15.000	0.028	20.000	0.067	24.999	0.130	29.998	0.225	34.997	0.357	39.994	0.533	44.988	0.759	49.980	1.041	**400**
360	5.000	0.001	10.000	0.009	15.000	0.031	20.000	0.074	24.999	0.145	29.998	0.250	34.996	0.397	39.992	0.593	44.986	0.844	49.976	1.157	**360**
350	5.000	0.001	10.000	0.010	15.000	0.032	20.000	0.076	24.999	0.149	29.998	0.257	34.996	0.408	39.992	0.609	44.985	0.868	49.975	1.190	**350**
300	5.000	0.001	10.000	0.011	15.000	0.037	20.000	0.089	24.999	0.174	29.997	0.300	34.994	0.476	39 989	0.711	44.980	1.012	49.965	1.388	**300**
250	5.000	0.002	10.000	0.013	15.000	0.045	19.999	0.107	24.998	0.208	29.996	0.360	34.992	0.572	39.984	0.853	44.970	1.214	49.950	1.665	**250**
230	5.000	0.002	10.000	0.014	15 000	0.049	19.999	0.116	24.998	0.226	29.995	0.391	34.990	0.621	39 981	0.927	44.965	1.320	49.941	1.810	**230**
200	5.000	0.002	10.000	0.017	15.000	0.056	19.999	0.133	24.998	0.260	29.994	0.450	34.987	0.714	39.974	1.066	44.954	1.518	49.922	2.081	**200**
170	5.000	0.002	10.000	0.020	15.000	0.066	19.999	0.157	24.997	0.306	29.992	0.529	34.982	0.840	39.965	1.254	44.936	1.785	49.892	2.447	**170**
155	5.000	0.003	10.000	0.022	15.000	0.073	19.999	0.172	24.996	0.336	29.990	0.581	34.978	0.922	39.957	1.375	44.923	1.957	49.870	2.683	**155**
125	5.000	0.003	10.000	0.027	15.000	0.090	19.998	0.213	24.994	0.417	29.984	0.720	34.966	1.143	39.935	1.705	44.882	2.425	49.800	3.324	**125**
100	5.000	0.004	10.000	0.033	14.999	0.112	19.997	0.267	24.990	0.521	29.976	0.899	34.948	1.428	39.898	2.129	44.816	3.029	49.688	4.148	**100**
90	5.000	0.005	10.000	0.037	14.999	0.125	19.996	0.296	24.988	0.579	29.970	0.999	34.935	1.586	39.874	2.365	44.773	3.363	49.616	4.604	**90**
80	5.000	0.005	10.000	0.042	14.999	0.141	19.995	0.333	24.985	0.651	29.962	1 124	34.918	1.783	39 840	2.659	44.713	3.780	49.514	5.172	**80**
70	5.000	0.006	10.000	0 048	14.998	0.161	19.993	0.381	24.980	0.744	29.950	1.284	34.893	2.037	39.792	3 036	44.625	4.313	49.366	5.898	**70**
60	5.000	0.007	10.000	0.056	14 998	0.187	19.991	0.444	24.973	0.867	29.933	1 498	34.854	2 375	39.716	3.538	44.490	5.021	19.139	6.859	**60**
55	5.000	0.008	10.000	0.061	14.997	0.205	19.989	0.485	24.968	0.946	29.920	1.633	34.827	2.589	39.663	3.855	44.394	5 469	48.977	7.465	**55**
50	5.000	0.008	10.000	0.067	14.997	0.225	19.987	0.533	24.961	1.041	29.903	1.796	34.790	2.846	39.592	4.236	44.267	6.004	48.764	8.186	**50**
45	5.000	0.009	10.000	0.074	14 996	0.250	19.984	0.592	24.952	1.156	29.880	1 994	34.742	3.159	39.497	4 698	44.097	6.653	48.479	9.057	**45**
40	5.000	0.010	9 999	0.083	14.995	0.281	19.980	0.666	24.939	1.300	29.848	2.242	34.673	3.549	39.365	5.273	43.860	7.456	48.082	10.130	**40**
35	5.000	0.012	9.999	0.095	14.994	0.321	19.974	0.761	24.920	1.485	29 802	2.559	34.574	4.048	39.172	6.005	43.517	8.473	47.509	11.478	**35**
33	5.000	0.013	9.999	0.101	14.993	0.341	19.971	0.807	24.910	1.574	29.778	2.713	34.521	4.288	39.070	6.357	43.335	8.960	47.206	12.118	**33**
30	5.000	0.014	9.999	0.111	14.992	0.375	19 964	0.888	24.892	1.731	29.731	2.981	34.421	4.707	38 877	6.968	42.992	9.800	46.638	13.215	**30**
25	5.000	0.017	9.998	0.133	14.988	0.450	19.949	1.065	23.844	2.074	29.614	3.567	34.169	5.619	38.392	8.287	42.136	11.592	45.226	15.513	**25**
23	5.000	0.018	9.998	0.145	14.986	0.489	19.940	1.157	24.816	2.253	29.544	3.870	34.020	6.089	38.107	8.960	41.635	12.493	44.407	16.643	**23**
20	5.000	0.021	9.998	0.167	14.981	0.562	19.920	1.330	24.757	2.586	29.398	4.435	33.710	6.957	37.515	10.189	40.601	14.111	42.732	18.621	**20**
15																					**15**
14																					**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 55 metre

R_C	Length of Transition Curve to Chord Points in Metre									L.T.	S.T.	L.C.	Θ_s	s	K	R_C	
	5.5	11.0	16.5	22.0	27.5	33.0	38.5	44.0	49.5	55.0							
R_C	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	°, ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 7	0 0 30	0 1 8	0 2 1	0 3 9	0 4 32	0 6 10	0 8 4	0 10 12	0 12 36	36.667	18.334	55.000	0 37 48	0.050	27.500	**2500**
2200	0 0 8	0 0 34	0 1 17	0 2 17	0 3 34	0 5 9	0 7 1	0 9 10	0 11 36	0 14 19	36.667	18.334	55.000	0 42 58	0.057	27.500	**2200**
2000	0 0 9	0 0 37	0 1 25	0 2 31	0 3 56	0 5 40	0 7 43	0 10 5	0 12 45	0 15 45	36.667	18.334	55.000	0 47 16	0.063	27.500	**2000**
1800	0 0 10	0 0 42	0 1 34	0 2 48	0 4 22	0 6 18	0 8 34	0 11 12	0 14 10	0 17 30	36.667	18.334	54.999	0 52 31	0.070	27.500	**1800**
1500	0 0 12	0 0 50	0 1 53	0 3 21	0 5 15	0 7 33	0 10 17	0 13 26	0 17 1	0 21 0	36.667	18.334	54.999	1 3 1	0.084	27.500	**1500**
1200	0 0 15	0 1 3	0 2 21	0 4 12	0 6 33	0 9 27	0 12 52	0 16 48	0 21 16	0 26 15	36.668	18.334	54.999	1 18 46	0.105	27.500	**1200**
1000	0 0 18	0 1 15	0 2 50	0 5 2	0 7 52	0 11 20	0 15 26	0 20 10	0 25 31	0 31 30	36.668	18.335	54.998	1 34 32	0.126	27.499	**1000**
900	0 0 21	0 1 24	0 3 9	0 5 36	0 8 45	0 12 36	0 17 9	0 22 24	0 28 21	0 35 0	36.668	18.335	54.998	1 45 2	0.140	27.499	**900**
800	0 0 23	0 1 34	0 3 32	0 6 18	0 9 50	0 14 10	0 19 18	0 25 12	0 31 54	0 39 23	36.669	18.335	54.997	1 58 10	0.158	27.499	**800**
700	0 0 27	0 1 48	0 4 3	0 7 12	0 11 15	0 16 12	0 22 3	0 28 48	0 36 27	0 45 1	36.670	18.336	54.996	2 15 3	0.180	27.499	**700**
600	0 0 31	0 2 6	0 4 43	0 8 24	0 13 7	0 18 54	0 25 44	0 33 36	0 42 32	0 52 31	36.671	18.337	54.995	2 37 33	0.210	27.498	**600**
500	0 0 37	0 2 31	0 5 40	0 10 5	0 15 45	0 22 41	0 30 52	0 40 20	0 51 2	1 3 1	36.672	18 339	54.993	3 9 4	0.252	27.497	**500**
400	0 0 47	0 3 9	0 7 5	0 12 36	0 19 41	0 28 21	0 38 36	0 50 25	1 3 48	1 18 46	36.676	18.342	54.988	3 56 20	0.315	27.496	**400**
360	0 0 52	0 3 30	0 7 52	0 14 0	0 21 53	0 31 30	0 42 53	0 56 1	1 10 54	1 27 31	36.678	18.344	54.986	4 22 36	0.350	27.495	**360**
350	0 0 54	0 3 36	0 8 6	0 14 24	0 22 30	0 32 24	0 44 7	0 57 37	1 12 55	1 30 1	36.679	18.344	54.985	4 30 6	0.360	27.494	**350**
300	0 1 3	0 4 12	0 9 27	0 16 48	0 26 15	0 37 48	0 51 28	1 7 13	1 25 4	1 45 2	36.683	18.348	54.979	5 15 7	0.420	27.492	**300**
250	0 1 15	0 5 2	0 11 20	0 20 10	0 31 30	0 45 22	1 1 45	1 20 40	1 42 5	2 6 2	36.690	18.354	54.970	6 18 9	0 504	27.489	**250**
230	0 1 22	0 5 28	0 12 19	0 21 55	0 34 15	0 49 19	1 7 8	1 27 40	1 50 58	2 16 59	36.694	18.358	54.965	6 51 2	0.548	27.487	**230**
200	0 1 34	0 6 18	0 14 10	0 25 12	0 39 23	0 56 43	1 17 12	1 40 50	2 7 36	2 37 32	36.703	18.366	54.954	7 52 41	0.630	27.483	**200**
170	0 1 51	0 7 24	0 16 40	0 29 39	0 46 20	1 6 43	1 30 49	1 58 37	2 30 7	3 5 19	36.717	18.379	54.936	9 16 6	0.741	27.476	**170**
155	0 2 1	0 8 7	0 18 17	0 32 31	0 50 49	1 13 11	1 39 36	2 10 6	2 44 39	3 23 15	36.727	18.388	54.923	10 9 55	0.812	27.471	**155**
125	0 2 31	0 10 5	0 22 41	0 40 20	1 3 1	1 30 45	2 3 31	2 41 19	3 24 8	4 11 59	36.759	18.418	54.881	12 36 18	1.007	27.455	**125**
100	0 3 9	0 12 36	0 28 21	0 50 25	1 18 46	1 53 26	2 34 23	3 21 37	4 15 8	5 14 55	36.812	18.466	54.814	15 45 22	1.257	27.429	**100**
90	0 3 30	0 14 0	0 31 30	0 56 1	1 27 31	2 6 2	2 51 32	3 44 1	4 43 28	5 49 51	36.845	18 498	54.770	17 30 25	1.396	27.412	**90**
80	0 3 56	0 15 45	0 35 27	1 3 1	1 38 28	2 21 47	3 12 58	4 11 59	5 18 51	6 33 30	36.893	18.542	54.708	19 41 43	1.569	27.388	**80**
70	0 4 30	0 18 0	0 40 30	1 12 1	1 52 32	2 42 2	3 40 31	4 47 57	6 4 20	7 29 35	36.962	18.607	54.618	22 30 32	1.791	27.353	**70**
60	0 5 15	0 21 0	0 47 16	1 24 1	2 11 17	3 9 1	4 17 14	5 35 53	7 4 55	8 44 16	37.067	18.708	54.477	26 15 38	2.085	27.297	**60**
55	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	37.143	18.781	54.376	28 38 52	2.271	27.257	**55**
50	0 6 18	0 25 12	0 56 43	1 40 50	2 37 32	3 46 48	5 8 38	6 42 56	8 29 38	10 28 37	37.242	18.878	54.241	31 30 45	2.494	27.202	**50**
45	0 7 0	0 28 0	1 3 1	1 52 2	2 55 2	4 11 59	5 42 52	7 27 35	9 26 2	11 38 2	37.375	19.011	54.058	35 0 50	2.764	27.126	**45**
40	0 7 52	0 31 30	1 10 54	2 6 2	3 16 54	4 43 28	6 25 39	8 23 22	10 36 26	13 4 37	37.561	19.201	53.798	39 23 27	3.098	27.016	**40**
35	0 9 0	0 36 0	1 21 1	2 24 2	3 45 1	5 23 54	7 20 37	9 34 59	12 6 46	14 55 35	37.831	19.484	53.413	45 1 5	3 523	26.848	**35**
33	0 9 32	0 38 11	1 25 56	2 32 45	3 58 38	5 43 30	7 47 15	10 9 40	12 50 28	15 49 13	37.975	19.639	53.205	47 44 47	3.726	26.755	**33**
30	0 10 30	0 42 0	1 34 31	2 48 2	4 22 29	6 17 48	8 33 49	11 10 17	14 6 49	17 22 47	38.246	19.939	52.805	52 31 16	4.078	26.571	**30**
25	0 12 36	0 50 25	1 53 26	3 21 37	5 14 55	7 33 10	10 16 7	13 23 17	16 54 0	20 47 12	38.935	20.746	51.760	63 1 31	4.829	26.065	**25**
23	0 13 42	0 54 48	2 3 17	3 39 9	5 42 16	8 12 27	11 9 23	14 32 27	18 20 46	22 32 56	39.348	21.260	51.120	68 30 21	5.209	25.737	**23**
20	0 15 45	1 3 1	2 21 47	4 11 59	6 33 30	9 26 2	12 49 3	16 41 40	21 2 27	25 49 13	40.238	22.431	49.733	78 46 54	5.893	24.984	**20**
15																	**15**
14																	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_C	Length of Transition Curve to Chord Points in Metre																						R_C
	5.5		11.0		16.5		22.0		27.5		33.0		38.5		44.0		49.5		55.0				
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10			metre
2500	5.500	0.000	11.000	0.002	16.500	0.005	22.000	0.013	27.500	0.025	33.000	0.044	38.500	0.069	44.000	0.103	49.500	0.147	54.999	0.202			2500
2200	5.500	0.000	11.000	0.002	16.500	0.006	22.000	0.015	27.500	0.029	33.000	0.049	38.500	0.079	44.000	0.117	49.499	0.167	54.999	0.229			2200
2000	5.500	0.000	11.000	0.002	16.500	0.007	22.000	0.016	27.500	0.032	33.000	0.054	38.500	0.086	44.000	0.129	49.499	0.184	54.999	0.252			2000
1800	5.500	0.000	11.000	0.002	16.500	0.008	22.000	0.018	27.500	0.035	33.000	0.060	38.500	0.096	44.000	0.143	49.499	0.204	54.999	0.280			1800
1500	5.500	0.000	11.000	0.003	16.500	0.009	22.000	0.022	27.500	0.042	33.000	0.073	38.500	0.115	43 999	0.172	49.499	0.245	54.998	0.336			1500
1200	5.500	0.000	11.000	0.003	16.500	0.011	22.000	0.027	27.500	0.053	33.000	0.091	38.500	0.144	43.999	0.215	49.498	0.306	54.997	0.420			1200
1000	5.500	0.001	11.000	0.004	16.500	0.014	22.000	0.032	27.500	0.063	33.000	0.109	38.499	0.173	43.999	0.258	49.498	0.368	54.996	0.504			1000
900	5.500	0.001	11.000	0.004	16.500	0.015	22.000	0.036	27.500	0.070	33.000	0.121	38.499	0.192	43.998	0.287	49.497	0.408	54.995	0.560			900
800	5.500	0.001	11.000	0.005	16.500	0.017	22.000	0.040	27.500	0.079	32.999	0.136	38.499	0.216	43.998	0.323	49.496	0.459	54.993	0.630			800
700	5.500	0.001	11.000	0.006	16.500	0.019	22.000	0.046	27.500	0.090	32.999	0.156	38.499	0.247	43..997	0.369	49.495	0.525	54.992	0.720			700
600	5.500	0.001	11.000	0.007	16.500	0.023	22.000	0.054	27.500	0.105	32.999	0.181	38.498	0.288	43.996	0.430	49.493	0.613	54.988	0.840			600
500	5.500	0.001	11.000	0.008	16.500	0.027	22.000	0.065	27.499	0.126	32.999	0.218	38.497	0.346	43.995	0.516	49.490	0.735	54.983	1.008			500
400	5.500	0.001	11.000	0.010	16.500	0.034	22.000	0.081	27.499	0.158	32.998	0.272	38.496	0.432	43.991	0.645	49.485	0.919	54.974	1.260			400
360	5.500	0.001	11.000	0.011	16.500	0.038	22.000	0.090	27.499	0.175	32.997	0.302	38 495	0.480	43.989	0.717	49.481	1.021	54.968	1.400			360
350	5.500	0.001	11.000	0.012	16.500	0.039	22.000	0.092	27.499	0.180	32.997	0.311	38.494	0.494	43.989	0.737	49.480	1.050	54 966	1.440			350
300	5.500	0.002	11.000	0.013	16.500	0.045	22.000	0.108	27.499	0.210	32.996	0.363	38.492	0.576	43.985	0.860	49.473	1.225	54.954	1.680			300
250	5.500	0.002	11.000	0.016	16.500	0.054	21.999	0.129	27.498	0.252	32.995	0.436	38.489	0.692	43.978	1.032	49.461	1.469	54.933	2.015			250
230	5.500	0.002	11.000	0.018	16.500	0.059	21.999	0.140	27.498	0.274	32 994	0.473	38.487	0.752	43.974	1.122	49.454	1.597	54.921	2.190			230
200	5.500	0.003	11.000	0 020	16.500	0.068	21.999	0.161	27.497	0.315	32.992	0.544	38.483	0.864	43.966	1.290	49.439	1.836	54.896	2.517			200
170	5.500	0.003	11.000	0.024	16.500	0.080	21.999	0.190	27.495	0.371	32.989	0.640	38.476	1.017	43.953	1.517	49.415	2.159	54.856	2.960			170
155	5.500	0 003	11.000	0.026	16.500	0.088	21.998	0.208	27.495	0.407	32.987	0.702	38.471	1.115	43.943	1.664	49.398	2 368	54.827	3.245			155
125	5.500	0.004	11.000	0.032	16.499	0.109	21.997	0.258	27.492	0.504	32.979	0.871	38.455	1.382	43.913	2.062	49.343	2.934	54.734	4.019			125
100	5.500	0.005	11.000	0.040	16.499	0.136	21.996	0.323	27.487	0.630	32.968	1.088	38.430	1.727	43.864	2.576	49.255	3.662	54.586	5.014			100
90	5.500	0.006	11.000	0.045	16.499	0.151	21.995	0.358	27.484	0.700	32.960	1.209	38.414	1.918	43.832	2.860	49.198	4 066	54.489	5.565			90
80	5.500	0 006	11.000	0.050	16.498	0.170	21.993	0.403	27.480	0.787	32.949	1.360	38.391	2.157	43 788	3.216	49.118	4.569	54 354	6.249			80
70	5.500	0.007	11.000	0.058	16.498	0.194	21.991	0 461	27.471	0.900	32.934	1.553	38.358	2.464	43.723	3.671	49.001	5.213	54.157	7.123			70
60	5.500	0.008	11.000	0.067	16.497	0.227	21.988	0.538	27.464	1.049	32.910	1.811	38.306	2.872	43.623	4.276	48.822	6.066	53.856	8.278			60
55	5.500	0.009	11.000	0.073	16.497	0.247	21.986	0.586	27.457	1.145	32.893	1.975	38.270	3.131	43.552	4.659	48.694	6.605	53.641	9.004			55
50	5.500	0.010	10.999	0.081	16.496	0.272	21.983	0.645	27.448	1.259	32.871	2.172	38.221	3.441	43.458	5.117	48.527	7.247	53.359	9.868			50
45	5.500	0.011	10.999	0.090	16.495	0.302	21.979	0.717	27.436	1.398	32 841	2.412	38.156	3.818	43.332	5.674	48.301	8.026	52.981	10.908			45
40	5.500	0 013	10.999	0.101	16.494	0.340	21.973	0.806	27.419	1.572	32.798	2.711	38.065	4.288	43.156	6.365	47.987	8.987	52.457	12.185			40
35	5.500	0.014	10.999	0.115	16.492	0.389	21.965	0.921	27.394	1.796	32.737	3.094	37.933	4.889	42.990	7.243	47.532	10.201	51.700	13.782			35
33	5.500	0.015	10.999	0.122	16.491	0.412	21.961	0.977	27.381	1.904	32.704	3.279	37.863	5.178	42.765	7.665	47.292	10.780	51.301	14.536			33
30	5.500	0.017	10.999	0.134	16.489	0.454	21.953	1.074	27.356	2.093	32.642	3.602	37.730	5.682	42.510	8.395	46.840	11.777	50.555	15.823			30
25	5.500	0.020	10.998	0.161	16.484	0.544	21.932	1.288	27.293	2.507	32.486	4.307	37.396	6.775	41.869	9.966	45.712	13.889	48.707	18.489			25
23	5.500	0.022	10.997	0.175	16.481	0.591	21.920	1.399	27.255	2.723	32.394	4.672	37.199	7.336	41.492	10.762	45.054	14.941	47.641	19.781			23
20	5.500	0.025	10.997	0.202	16.475	0.680	21.894	1.608	27.177	3.125	32.201	5.350	36.789	8.370	40.713	12.210	43.702	16.812	45 472	22.002			20
15																							15
14																							14

Ls=55 metre

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_C	Length of Transition Curve to Chord Points in Metre														Ls=60 metre		
	6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0	54.0	60.0	L. T.	S. T	L. C.	Θ_s	s	K	R_O
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 8	0 0 33	0 1 14	0 2 12	0 3 26	0 4 57	0 6 44	0 8 48	0 11 8	0 13 45	40.000	20.000	60.000	0 41 15	0.060	30.000	**2500**
2200	0 0 9	0 0 37	0 1 24	0 2 30	0 3 54	0 5 37	0 7 39	0 10 0	0 12 39	0 15 37	40.000	20.000	60.000	0 46 52	0.068	30.000	**2200**
2000	0 0 10	0 0 41	0 1 32	0 2 45	0 4 17	0 6 11	0 8 25	0 11 0	0 13 55	0 17 11	40.000	20.000	59.999	0 51 33	0.075	30.000	**2000**
1800	0 0 11	0 0 45	0 1 43	0 3 3	0 4 46	0 6 52	0 9 21	0 12 13	0 15 28	0 19 5	40.001	20.001	59.999	0. 57 17	0.083	30.000	**1800**
1500	0 0 13	0 0 55	0 2 3	0 3 40	0 5 43	0 8 15	0 11 13	0 14 40	0 18 33	0 22 55	40.001	20.001	59.999	1 8 45	0.100	30.000	**1500**
1200	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	40.001	20.001	59.998	1 25 56	0.125	29.999	**1200**
1000	0 0 20	0 1 22	0 3 5	0 5 30	0 8 35	0 12 22	0 16 50	0 22 0	0 27 50	0 34 22	40.002	20.002	59.998	1 43 7	0.150	29.999	**1000**
900	0 0 22	0 1 31	0 3 26	0 6 6	0 9 32	0 13 45	0 18 42	0 24 26	0 30 56	0 38 11	40.002	20.002	59.997	1 54 35	0.167	29.999	**900**
800	0 0 25	0 1 43	0 3 52	0 6 52	0 10 44	0 15 28	0 21 3	0 27 30	0 34 48	0 42 58	40.003	20.003	59.996	2 8 54	0.187	29.999	**800**
700	0 0 29	0 1 57	0 4 25	0 7 51	0 12 16	0 17 40	0 24 3	0 31 25	0 39 46	0 49 6	40.003	20.004	59.995	2 27 19	0.214	29.998	**700**
600	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17	40.005	20.005	59.993	2 51 53	0.250	29.998	**600**
500	0 0 41	0 2 45	0 6 11	0 11 0	0 17 11	0 24 45	0 33 41	0 44 0	0 55 41	1 8 45	40.008	20.007	59.990	3 26 15	0.300	29.996	**500**
400	0 0 51	0 3 26	0 7 44	0 13 45	0 21 29	0 30 56	0 42 6	0 55 0	1 9 36	1 25 56	40.012	20.011	59.985	4 17 49	0.375	29.994	**400**
360	0 0 57	0 3 49	0 8 35	0 15 16	0 23 52	0 34 22	0 46 47	1 1 6	1 17 20	1 35 29	40.015	20.013	59.981	4 46 28	0.417	29.993	**360**
350	0 0 58	0 3 55	0 8 50	0 15 42	0 24 33	0 35 21	0 48 7	1 2 51	1 19 33	1 38 12	40.015	20.014	59.980	4 54 39	0.428	29.993	**350**
300	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34	40.021	20.019	59.973	5 43 46	0.500	29.990	**300**
250	0 1 22	0 5 30	0 12 22	0 22 0	0 34 22	0 49 30	1 7 22	1 28 0	1 51 22	2 17 29	40.030	20.027	59.962	6 52 31	0.600	29.986	**250**
230	0 1 29	0 5 58	0 13 27	0 23 54	0 37 21	0 53 48	1 13 14	1 35 39	2 1 3	2 29 26	40.036	20.032	59.955	7 28 24	0.652	29.983	**230**
200	0 1 43	0 6 52	0 15 28	0 27 30	0 42 58	1 1 52	1 24 13	1 49 59	2 19 12	2 51 51	40.047	20.043	59.940	8 35 39	0.749	29.977	**200**
170	0 2 1	0 8 5	0 18 11	0 32 21	0 50 33	1 12 47	1 39 4	2 9 24	2 43 46	3 22 10	40.065	20.060	59.917	10 6 39	0.881	29.969	**170**
155	0 2 13	0 8 52	0 19 57	0 35 29	0 55 26	1 19 50	1 48 40	2 21 55	2 59 36	3 41 43	40.078	20.072	59.900	11 5 22	0.966	29.962	**155**
125	0 2 45	0 11 0	0 24 45	0 44 0	1 8 45	1 39 0	2 14 44	2 55 58	3 42 41	4 34 53	40.120	20.110	59.846	13 45 3	1.198	29.942	**125**
100	0 3 26	0 13 45	0 30 56	0 55 0	1 25 56	2 3 44	2 48 25	3 39 56	4 38 19	5 43 30	40.188	20.173	59.758	17 11 19	1.495	29.908	**100**
90	0 3 49	0 15 16	0 34 22	1 1 6	1 35 29	2 17 29	3 7 7	4 4 22	5 9 12	6 21 36	40.232	20.214	59.701	19 5 54	1.660	29.886	**90**
80	0 4 17	0 17 11	0 38 40	1 8 45	1 47 25	2 34 40	3 30 30	4 34 53	5 47 47	7 9 12	40.293	20.272	59.620	21 29 9	1.866	29.854	**80**
70	0 4 54	0 19 38	0 44 11	1 18 34	2 2 45	2 56 45	4 0 33	5 14 6	6 37 23	8 10 20	40.382	20.357	59.502	24 33 19	2.129	29.808	**70**
60	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	40.519	20.489	59.319	28 38 52	2.478	29.734	**60**
55	0 6 15	0 25 0	0 56 15	1 40 0	2 36 14	3 44 56	5 6 5	6 39 36	8 25 26	10 23 27	40.617	20.585	59.186	31 15 8	2.698	29.680	**55**
50	0 6 52	0 27 30	1 1 52	1 49 59	2 51 51	4 7 25	5 36 39	7 19 28	9 15 47	11 25 26	40.746	20.712	59.010	34 22 38	2.962	29.608	**50**
45	0 7 38	0 30 33	1 1 45	2 2 13	3 10 56	4 34 53	6 13 59	8 8 10	10 17 15	12 41 2	40.918	20.887	58.770	38 11 49	3.281	29.507	**45**
40	0 8 35	0 34 22	1 17 20	2 17 29	3 34 47	5 9 12	7 0 38	9 8 57	11 33 56	14 15 17	41.159	21.137	58.429	42 58 18	3.676	29.359	**40**
35	0 9 49	0 39 17	1 28 23	2 37 7	4 5 27	5 53 18	8 0 33	10 27 0	13 12 18	16 15 59	41.509	21.514	57.922	49 6 38	4.175	29.133	**35**
33	0 10 25	0 41 40	1 33 45	2 46 38	4 20 19	6 14 41	8 29 35	11 4 47	13 59 53	17 14 18	41.695	21.721	57.647	52 5 13	4.414	29.006	**33**
30	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58	42.047	22.123	57.119	57 17 44	4.825	28.756	**30**
25	0 13 45	0 55 0	2 3 44	3 39 56	5 43 30	8 14 15	11 11 48	14 35 36	18 24 42	22 37 44	42.946	23.220	55.733	68 45 17	5.701	28.059	**25**
23	0 14 56	0 59 47	2 14 30	3 59 3	6 13 19	8 57 4	12 9 49	15 50 51	19 58 55	24 32 14	43.492	23.928	54.882	74 44 1	6.139	27.604	**23**
20	0 17 11	1 8 45	2 34 40	4 34 53	7 9 12	10 17 15	13 58 20	18 11 18	22 54 15	28 4 18	44.691	25.574	53.038	85 56 37	6.925	26.550	**20**
15																	**15**
14																	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 60 metre

R_C	Length of Transition Curve to Chord Points in Metre																R_C				
	6.0		12.0		18.0		24.0		30.0		36.0		42.0		48.0		54.0		60.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	6.000	0.000	12.000	0.002	18.000	0.006	24.000	0.015	30.000	0.030	36.000	0.052	42.000	0.082	48.000	0.123	53.999	0.175	59.999	0.240	2500
2200	6.000	0.000	12.000	0.002	18.000	0.007	24.000	0.017	30.000	0.034	36.000	0.059	42.000	0.094	48.000	0.140	53.999	0.199	59.999	0.273	2200
2000	6.000	0.000	12.000	0.002	18.000	0.008	24.000	0.019	30.000	0.037	36.000	0.065	42.000	0.103	48.000	0.154	53.999	0.219	59.999	0.300	2000
1800	6.000	0.000	12.000	0.003	18.000	0.009	24.000	0.021	30.000	0.042	36.000	0.072	42.000	0.114	47.999	0.171	53.999	0.243	59.998	0.333	1800
1500	6.000	0.000	12.000	0.003	18.000	0.011	24.000	0.026	30.000	0.050	36.000	0.086	42.000	0.137	47.999	0.205	53.999	0.292	59.998	0.400	1500
1200	6.000	0.001	12.000	0.004	18.000	0.013	24.000	0.032	30.000	0.062	36.000	0.108	41.999	0.171	47.999	0.256	53.998	0.364	59.996	0.500	1200
1000	6.000	0.001	12.000	0.005	18.000	0.016	24.000	0.038	30.000	0.075	36.000	0.130	41.999	0.206	47.998	0.307	53.997	0.437	59.995	0.600	1000
900	6.000	0.001	12.000	0.005	18.000	0.018	24.000	0.043	30.000	0.083	35.999	0.144	41.999	0.229	47.998	0.341	53.996	0.486	59.993	0.667	900
800	6.000	0.001	12.000	0.006	18.000	0.020	24.000	0.048	30.000	0.094	35.999	0.162	41.999	0.257	47.997	0.384	53.995	0.547	59.992	0.750	800
700	6.000	0.001	12.000	0.007	18.000	0.023	24.000	0.055	30.000	0.107	35.999	0.185	41.998	0.294	47.996	0.439	53.993	0.625	59.989	0.857	700
600	6.000	0.001	12.000	0.008	18.000	0.027	24.000	0.064	30.000	0.125	35.999	0.216	41.997	0.343	47.995	0.512	53.991	0.729	59.985	1.000	600
500	6.000	0.001	12.000	0.010	18.000	0.032	24.000	0.077	29.999	0.150	35.998	0.259	41.996	0.412	47.993	0.614	53.987	0.875	59.978	1.200	500
400	6.000	0.002	12.000	0.012	18.000	0.040	24.000	0.096	29.999	0.187	35.997	0.324	41.994	0.514	47.989	0.768	53.980	1.093	59.966	1.499	400
360	6.000	0.002	12.000	0.013	18.000	0.045	24.000	0.107	29.999	0.208	35.997	0.360	41.993	0.572	47.986	0.853	53.975	1.215	59.958	1.666	360
350	6.000	0.002	12.000	0.014	18.000	0.046	24.000	0.110	29.999	0.214	35.997	0.370	41.993	0.588	47.986	0.878	53.974	1.249	59.956	1.713	350
300	6.000	0.002	12.000	0.016	18.000	0.054	23.999	0.128	29.998	0.250	35.995	0.432	41.990	0.686	47.980	1.024	53.965	1.457	59.940	1.999	300
250	6.000	0.002	12.000	0.019	18.000	0.065	23.999	0.154	29.997	0.300	35.993	0.518	41.985	0.823	47.972	1.228	53.949	1.748	59.914	2.398	250
230	6.000	0.003	12.000	0.021	18.000	0.070	23.999	0.167	29.997	0.326	35.992	0.563	41.983	0.895	47.967	1.335	53.940	1.900	59.898	2.606	230
200	6.000	0.003	12.000	0.024	18.000	0.081	23.999	0.192	29.996	0.375	35.990	0.648	41.977	1.029	47.956	1.535	53.920	2.185	59.865	2.995	200
170	6.000	0.004	12.000	0.028	18.000	0.095	23.998	0.226	29.994	0.441	35.985	0.762	41.969	1.210	47.939	1.805	53.890	2.569	59.813	3.522	170
155	6.000	0.004	12.000	0.031	17.999	0.105	23.998	0.248	29.993	0.484	35.983	0.836	41.962	1.327	47.926	1.980	53.867	2.817	59.776	3.861	155
125	6.000	0.005	12.000	0.038	17.999	0.130	23.996	0.307	29.989	0.600	35.973	1.036	41.942	1.645	47.887	2.453	53.796	3.490	59.655	4.780	125
100	6.000	0.006	12.000	0.048	17.999	0.162	23.994	0.384	29.983	0.750	35.958	1.295	41.909	2.055	47.823	3.064	53.682	4.356	59.462	5.962	100
90	6.000	0.007	12.000	0.053	17.998	0.180	23.993	0.427	29.979	0.833	35.948	1.439	41.888	2.282	47.782	3.402	53.608	4.835	59.337	6.614	90
80	6.000	0.007	12.000	0.060	17.998	0.202	23.991	0.480	29.974	0.937	35.934	1.618	41.858	2.566	47.724	3.824	53.504	5.432	59.162	7.425	80
70	6.000	0.009	12.000	0.069	17.997	0.231	23.989	0.548	29.966	1.071	35.914	1.848	41.815	2.931	47.640	4.365	53.353	6.195	58.907	8.460	70
60	6.000	0.010	12.000	0.080	17.996	0.270	23.985	0.640	29.953	1.249	35.884	2.155	41.749	3.415	47.511	5.083	53.121	7.205	58.517	9.823	60
55	6.000	0.011	11.999	0.087	17.996	0.294	23.982	0.698	29.944	1.362	35.861	2.350	41.701	3.723	47.418	5.537	52.955	7.843	58.239	10.679	55
50	6.000	0.012	11.999	0.096	17.995	0.324	23.978	0.767	29.933	1.498	35.832	2.583	41.638	4.091	47.297	6.080	52.738	8.602	57.876	11.695	50
45	6.000	0.013	11.999	0.107	17.994	0.360	23.973	0.853	29.917	1.663	35.793	2.868	41.554	4.539	47.134	6.738	52.446	9.519	57.388	12.916	45
40	6.000	0.015	11.999	0.120	17.992	0.405	23.965	0.959	29.895	1.870	35.738	3.223	41.436	5.096	46.906	7.555	52.041	10.650	56.712	14.408	40
35	6.000	0.017	11.999	0.137	17.989	0.463	23.955	1.096	29.863	2.136	35.659	3.678	41.265	5.806	46.576	8.590	51.454	12.073	55.739	16.264	35
33	6.000	0.018	11.998	0.145	17.988	0.491	23.949	1.162	29.845	2.264	35.616	3.897	41.174	6.149	46.400	9.086	51.145	12.750	55.227	17.136	33
30	6.000	0.020	11.998	0.160	17.985	0.540	23.939	1.278	29.813	2.489	35.536	4.280	41.003	6.743	46.071	9.944	50.563	13.911	54.271	18.616	30
25	6.000	0.024	11.997	0.192	17.979	0.647	23.912	1.532	29.731	2.981	35.334	5.115	40.571	8.031	45.245	11.780	49.116	16.350	51.917	21.642	25
23	6.000	0.026	11.997	0.209	17.975	0.704	23.896	1.664	29.683	3.236	35.214	5.547	40.316	8.690	44.761	12.706	48.276	17.554	50.565	23.083	23
20	6.000	0.030	11.996	0.240	17.967	0.809	23.862	1.912	29.581	3.713	34.964	6.346	39.787	9.900	43.761	14.378	46.555	19.669	47.833	25.510	20
15																					15
14																					14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls= 65 metre

R_c	Length of Transition Curve to Chord Points in Metre										L.T	S.T.	L.C.	Θ_s	s	K	R_c
	6.5	13.0	19.5	26.0	32.5	39.0	45.5	52.0	58.5	65.5							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 8	0 0 35	0 1 20	0 2 23	0 3 43	0 5 21	0 7 17	0 9 32	0 12 3	0 14 53	43.334	21.667	64.999	0 44 41	0.070	32.500	**2500**
2200	0 0 10	0 0 40	0 1 31	0 2 42	0 4 13	0 6 5	0 8 17	0 10 50	0 13 42	0 16 55	43.334	21.667	64.999	0 50 47	0.080	32.500	**2200**
2000	0 0 11	0 0 44	0 1 40	0 2 58	0 4 39	0 6 42	0 9 7	0 11 55	0 15 4	0 18 37	43.334	21.667	64.999	0 55 51	0.088	32.500	**2000**
1800	0 0 12	0 0 49	0 1 51	0 3 18	0 5 10	0 7 26	0 10 8	0 13 14	0 16 45	0 20 41	43.334	21.667	64.999	1 2 4	0.098	32.500	**1800**
1500	0 0 14	0 0 59	0 2 14	0 3 58	0 6 12	0 8 56	0 12 9	0 15 53	0 20 6	0 24 49	43.334	21.668	64.999	1 14 29	0.117	32.499	**1500**
1200	0 0 18	0 1 14	0 2 47	0 4 57	0 7 45	0 11 10	0 15 12	0 19 51	0 25 8	0 31 2	43.335	21.668	64.998	1 33 6	0.147	32.499	**1200**
1000	0 0 22	0 1 29	0 3 21	0 5 57	0 9 18	0 13 24	0 18 14	0 23 50	0 30 9	0 37 14	43.336	21.669	64.997	1 51 43	0.176	32.499	**1000**
900	0 0 24	0 1 39	0 3 43	0 6 37	0 10 20	0 14 53	0 20 16	0 26 28	0 26 31	0 41 22	43.336	21.669	64.996	2 4 8	0 196	32.499	**900**
800	0 0 27	0 1 51	0 4 11	0 7 26	0 11 38	0 16 45	0 22 48	0 29 47	0 37 42	0 46 33	43.337	21.670	64.995	2 19 39	0.220	32.498	**800**
700	0 0 31	0 2 7	0 4 47	0 8 30	0 13 18	0 19 9	0 26 4	0 34 2	0 43 5	0 53 12	43.338	21.671	64.994	2 39 36	0.251	32.498	**700**
600	0 0 37	0 2 28	0 5 35	0 9 55	0 15 31	0 22 20	0 30 24	0 39 43	0 50 16	1 2 4	43.340	21.673	64.992	3 6 12	0.293	32.497	**600**
500	0 0 44	0 2 58	0 6 42	0 11 55	0 18 37	0 26 48	0 36 29	0 47 40	1 0 19	1 14 28	43.343	21.675	64.988	3 43 27	0.352	32.495	**500**
400	0 0 55	0 3 43	0 8 22	0 14 53	0 23 16	0 33 31	0 45 37	0 59 35	1 15 24	1 33 6	43.348	21.680	64.981	4 39 19	0.440	32.493	**400**
360	0 1 3	0 4 8	0 9 18	0 16 33	0 25 51	0 37 14	0 50 41	1 6 12	1 23 47	1 43 26	43.352	21.684	64.976	5 10 21	0.489	32.491	**360**
350	0 1 3	0 4 15	0 9 34	0 17 1	0 26 36	0 38 18	0 52 8	1 8 5	1 26 11	1 46 23	43.353	21.684	64.975	5 19 13	0.503	32.491	**350**
300	0 1 14	0 4 57	0 11 10	0 19 51	0 31 2	0 44 41	1 0 49	1 19 26	1 40 32	2 4 7	43.360	21.691	64.966	6 12 25	0.587	32.486	**300**
250	0 1 29	0 5 57	0 13 24	0 23 50	0 37 14	0 53 37	1 12 59	1 35 20	2 0 39	2 28 56	43.372	21.702	64.951	7 26 54	0.704	32.482	**250**
230	0 1 37	0 6 28	0 14 34	0 25 54	0 40 28	0 58 17	1 19 20	1 43 37	2 11 8	2 41 53	43.379	21.708	64.942	8 5 46	0.765	32.478	**230**
200	0 1 51	0 7 26	0 16 45	0 29 47	0 46 33	1 7 2	1 31 14	1 59 9	2 30 48	3 6 10	43.393	21.721	64.924	9 18 38	0.879	32.471	**200**
170	0 2 11	0 8 45	0 19 42	0 35 3	0 54 46	1 18 51	1 47 20	2 20 11	2 57 24	3 39 0	43.416	21.742	64.894	10 57 13	1.034	32.460	**170**
155	0 2 24	0 9 36	0 21 37	0 38 26	1 0 4	1 26 29	1 57 43	2 33 45	3 14 34	4 0 10	43.433	21.758	64.873	12 0 49	1.134	32.452	**155**
125	0 2 58	0 11 55	0 26 48	0 47 40	1 14 28	1 47 14	2 25 58	3 10 38	4 1 14	4 57 46	43.486	21.807	64.804	14 53 48	1.405	32.426	**125**
100	0 3 43	0 14 53	0 33 31	0 59 35	1 33 6	2 14 3	3 2 26	3 58 15	5 1 29	6 12 5	43.572	21.887	64.692	18 37 16	1.754	32.383	**100**
90	0 4 8	0 16 33	0 37 14	1 6 12	1 43 26	2 28 56	3 22 42	4 24 42	5 34 56	6 53 20	43.628	21.939	64.619	20 41 24	1.947	32.354	**90**
80	0 4 39	0 18 37	0 41 53	1 14 28	1 56 22	2 47 33	3 48 1	4 57 46	6 16 43	7 44 52	43.706	22.013	64.516	23 16 35	2.188	32.314	**80**
70	0 5 19	0 21 16	0 47 52	1 25 7	2 12 59	3 11 29	4 20 34	5 40 14	7 10 25	8 51 3	43.819	22.122	64.366	26 36 5	2.496	32.254	**70**
60	0 6 12	0 24 49	0 55 51	1 39 18	2 35 9	3 43 22	5 3 57	6 36 50	8 21 56	10 19 9	43.993	22.291	64.131	31 2 6	2.903	32.159	**60**
55	0 6 46	0 27 5	1 0 56	1 48 19	2 49 15	4 3 40	5 31 33	7 12 30	9 7 24	11 15 6	44.117	22.414	63.961	33 51 23	3.161	32.089	**55**
50	0 7 26	0 29 47	1 7 2	1 59 9	3 6 10	4 28 1	6 4 39	7 55 59	10 1 53	12 22 9	44.280	22.578	63.736	37 14 32	3.468	31.994	**50**
45	0 8 16	0 33 6	1 14 28	2 12 24	3 26 50	4 57 46	6 45 5	8 48 42	11 8 24	13 43 54	44.499	22.804	63.427	41 22 49	3.840	31.862	**45**
40	0 9 18	0 37 14	1 23 47	2 28 56	3 52 40	5 34 56	7 35 36	9 54 30	12 31 21	15 25 46	44.804	23.128	62.988	46 33 10	4.299	31.669	**40**
35	0 10 38	0 42 33	1 35 45	2 50 13	4 25 53	6 22 42	8 40 28	11 18 56	14 17 42	17 36 8	45.248	23 619	62.334	53 12 11	4.878	31.369	**35**
33	0 11 17	0 45 8	1 41 33	3 0 31	4 41 59	6 45 50	9 11 53	11 59 49	15 9 7	18 39 3	45.485	23.890	61 979	56 25 39	5.154	31.200	**33**
30	0 12 24	0 49 39	1 51 43	3 18 34	5 10 9	7 26 19	10 6 49	13 11 13	16 38 51	20 28 43	45 933	24.421	61.295	62 4 13	5.628	30.866	**30**
25	0 14 53	0 59 35	2 14 3	3 58 15	6 12 5	8 55 17	12 7 24	15 47 43	19 55 0	24 27 29	47.090	25.887	59.496	74 29 4	6.631	29.926	**25**
23	0 16 11	1 4 46	2 25 42	4 18 57	6 44 22	9 41 38	13 10 9	17 8 59	21 36 33	26 30 29	47.803	26.851	58.390	80 57 41	7.130	29.307	**23**
20																	**20**
15																	**15**
14																	**14**

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 65 meter

R_C	Length of Transition Curve to Chord Points in Metre										R_C
	6.5	13.0	19.5	26.0	32.5	39.0	45.5	52.0	58.5	65.0	
metre	X 1 Y 1	X 2 Y2	X 3 Y 3	X 4 Y 4	X 5 Y 5	X 6 Y 6	X 7 Y 7	X 8 Y 8	X 9 Y 9	X 10 Y 10	metre
2500	6.500 0.000	13.000 0.002	19.500 0.008	26.000 0.018	32.500 0.035	39.000 0.061	45.500 0.097	52.000 0.144	58.499 0.205	64.999 0.282	2500
2200	6.500 0.000	13.000 0.003	19.500 0.009	26.000 0.020	32.500 0.040	39.000 0.069	45.500 0.110	52.000 0.164	58.499 0.233	64.999 0.320	2200
2000	6.500 0.000	13.000 0.003	19.500 0.010	26.000 0.023	32.500 0.044	39.000 0.076	45.500 0.121	51.999 0.180	58.499 0.257	64.998 0.352	2000
1800	6.500 0.000	13 000 0.003	19.500 0.011	26.000 0.025	32.500 0.049	39.000 0.084	45.500 0.134	51 999 0.200	58.499 0.285	64.998 0.391	1800
1500	6.500 0.000	13.000 0.004	19.500 0.013	26.000 0.030	32.500 0.059	39.000 0.101	45.499 0.161	51.999 0.240	58.498 0.342	64.997 0.469	1500
1200	6.500 0.001	13.000 0.005	19.500 0.016	26.000 0.038	32.500 0.073	39.000 0.127	45.499 0.201	51.998 0.300	58.497 0.428	64.995 0.587	1200
1000	6.500 0.001	13.000 0.006	19.500 0.019	26.000 0.045	32.500 0.088	38.999 0.152	45.499 0.242	51.998 0.361	58.496 0.513	64.993 0.704	1000
900	6.500 0.001	13.000 0.006	19.500 0.021	26.000 0.050	32.500 0.098	38.999 0.169	45.499 0.268	51.997 0.401	58.495 0.570	64.992 0.782	900
800	6.500 0.001	13.000 0.007	19.500 0.024	26.000 0.056	32.500 0.110	38.999 0.190	45.498 0.302	51.996 0.451	58.494 0.642	64.989 0.880	800
700	6.500 0.001	13.000 0.008	19.500 0.027	26.000 0.064	32.500 0.126	38.999 0.217	45.498 0.345	51.995 0.515	58.492 0.733	64.986 1.006	700
600	6.500 0.001	13.000 0.009	19.500 0.032	26.000 0.075	32.499 0.147	38.999 0.253	45.497 0.403	51.994 0.601	58.489 0.855	64.981 1.173	600
500	6.500 0.001	13.000 0.011	19.500 0.038	26.000 0.090	32.499 0.176	38.998 0.304	45.495 0.483	51.991 0.721	58.484 1.026	64.973 1.408	500
400	6.500 0.002	13.000 0.014	19.500 0.048	26.000 0.113	32.499 0.220	38.997 0.380	45.493 0.604	51.986 0.901	58.475 1.283	64.957 1.760	400
360	6.500 0.002	13.000 0.016	19.500 0.053	25.999 0.125	32.498 0.244	38.996 0.422	45.491 0.671	51.983 1.001	58.469 1.425	64.947 1.955	360
350	6.500 0.002	13.000 0.016	19.500 0.054	25.999 0.129	32.498 0.251	38.996 0.435	45.491 0.690	51.982 1.030	58.467 1.466	64.944 2.011	350
300	6.500 0.002	13.000 0.019	19.500 0.063	25.999 0.150	32.498 0.293	38.994 0.507	45.487 0.805	51.975 1.201	58.455 1.710	64.924 2.345	300
250	6.500 0.003	13.000 0.023	19.500 0.076	25.999 0.180	32.497 0.352	38.991 0.608	45.482 0.966	51.964 1.441	58.435 2.052	64.890 2.813	250
230	6.500 0.003	13.000 0.024	19.500 0.083	25.999 0.196	32.496 0.383	38.990 0.661	45.478 1.050	51.957 1.567	58.423 2.230	64.870 3.057	230
200	6.500 0.004	13.000 0.028	19.500 0.095	25.998 0.225	32.495 0.440	38.987 0.760	45.471 1.207	51.944 1.801	58.399 2.564	64.829 3.514	200
170	6.500 0.004	13.000 0.033	19.499 0.112	25.998 0.265	32.493 0.518	38.982 0.894	45.460 1.420	51.922 2.119	58.360 3.014	64.763 4.131	170
155	6.500 0.005	13.000 0.036	19.499 0.123	25.997 0.291	32.491 0.568	38.978 0.981	45.452 1.557	51.906 2.323	58.331 3.305	64.715 4.529	155
125	6.500 0.006	13.000 0.045	19.499 0.152	25.995 0.360	32.486 0.704	38.966 1.216	45.426 1.930	51.856 2.879	58.241 4.094	64.562 5.606	125
100	6.500 0.007	13.000 0.056	19.498 0.190	25.993 0.451	32.479 0.880	38.947 1.520	45.385 2.411	51.775 3.594	58.096 5.108	64.317 6.989	100
90	6.500 0.008	13.000 0.063	19.498 0.211	25.991 0.501	32.474 0.977	38.934 1.688	45.358 2.678	51.723 3.991	58.001 5.669	64.158 7.751	90
80	6.500 0.009	13.000 0.070	19.497 0.238	25.989 0.563	32.466 1.099	38.917 1.898	45.320 3.011	51.650 4.485	57.870 6.367	63.935 8.699	80
70	6.500 0 010	13.000 0.080	19.497 0.272	25.986 0.644	32.456 1.256	38.891 2.169	45.265 3.438	51.543 5.118	57.678 7.260	63.613 9.906	70
60	6.500 0.012	12.999 0.094	19.495 0.317	25.980 0.751	32.440 1.465	38.852 2.528	45.181 4.005	51.379 5.958	57.384 8.439	63.119 11.492	60
55	6.500 0.013	12.999 0.102	19.494 0.346	25.977 0.819	32.429 1.598	38.824 2.757	45.120 4.365	51.261 6.488	57.174 9.182	62.767 12.487	55
50	6.500 0.014	12.999 0.113	19.493 0.380	25.972 0.901	32.414 1.757	38.787 3.030	45.041 4.796	51.107 7.122	56.899 10.065	62.307 13.664	50
45	6.500 0.016	12.999 0.125	19.492 0.422	25.965 1.001	32.394 1.951	38.737 3.364	44.933 5.319	50.900 7.890	56.529 11.132	61.690 15.075	45
40	6.500 0.018	12.999 0.141	19.490 0.475	25.956 1.125	32.366 2.194	38.668 3.779	44.784 5.970	50.611 8.841	56.016 12.442	60.838 16.791	40
35	6.500 0.020	12.998 0.161	19.486 0.543	25.943 1.286	32.325 2.505	38.566 4.311	44.567 6.799	50.193 10.044	55.276 14.085	59.615 18.913	35
33	6.500 0.021	12.998 0.171	19.485 0.576	25.936 1 363	32.304 2.656	38.513 4.568	44.452 7.198	49.972 10.619	54.885 14.863	58.972 19.905	33
30	6.500 0.023	12.998 0.188	19.481 0.633	25.922 1.499	32.262 2.919	38.411 5.015	44.234 7.890	49.555 11.611	54.153 16.193	57.775 21.577	30
25	6.500 0.028	12.996 0.225	19.473 0.760	25.888 1.797	32.158 3,494	38.154 5.989	43.688 9.385	48.514 13.724	52.338 18.963	54.841 24.944	25
23	6.500 0.031	12.996 0.245	19.468 0.826	25.867 1.952	32.097 3,793	38.003 6.492	43.367 10.147	47.905 14.783	51.287 20.316	53.166 26.517	23
20											20
15											15
14											14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_c	Length of Transition Curve to Chord Points in Metre											L.T.	S.T.	L.C.	Θ_s	Ls 70= metre s	K	R_c
	7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	63.0	70.0								
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10								
metre	′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″		metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 9	0 0 38	0 1 26	0 2 34	0 4 0	0 5 46	0 7 51	0 10 16	0 12 59	0 16 2		46.667	23.334	69.999	0 48 7	0.082	35.000	**2500**
2200	0 0 10	0 0 43	0 1 38	0 2 55	0 4 33	0 6 33	0 8 55	0 11 40	0 14 46	0 18 13		46.667	23.334	69.999	0 54 41	0.093	35.000	**2200**
2000	0 0 12	0 0 48	0 1 48	0 3 12	0 5 0	0 7 13	0 9 49	0 12 50	0 16 14	0 20 3		46 667	23.334	69.999	1 0 9	0.102	35.000	**2000**
1800	0 0 13	0 0 53	0 2 0	0 3 33	0 5 34	0 8 1	0 10 55	0 14 15	0 18 2	0 22 16		46.668	23.334	69.999	1 6 50	0 113	35.000	**1800**
1500	0 0 16	0 1 4	0 2 24	0 4 16	0 6 41	0 9 37	0 13 6	0 17 6	0 21 39	0 26 44		46.668	23.335	69.998	1 20 12	0.136	34.999	**1500**
1200	0 0 20	0 1 20	0 3 0	0 5 20	0 8 21	0 12 1	0 16 22	0 21 23	0 27 4	0 33 25		46.669	23.335	69.997	1 40 16	0.170	34.999	**1200**
1000	0 0 24	0 1 36	0 3 36	0 6 25	0 10 1	0 14 26	0 19 39	0 25 40	0 32 29	0 40 6		46.670	23.336	69 996	2 0 19	0.204	34.999	**1000**
900	0 0 26	0 1 46	0 4 0	0 7 7	0 11 8	0 16 2	0 21 50	0 28 31	0 36 5	0 44 33		46.670	23.337	69.095	2 13 41	0.227	34.998	**900**
800	0 0 30	0 2 0	0 4 30	0 8 1	0 12 32	0 18 2	0 24 33	0 32 5	0 40 36	0 50 7		46.671	23.338	69.994	2 30 24	0.255	34.998	**800**
700	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17		46.673	23.339	69.992	2 51 53	0.292	34.997	**700**
600	0 0 40	0 2 40	0 6 0	0 10 41	0 16 42	0 24 3	0 32 45	0 42 46	0 54 8	1 6 50		46.675	23.341	69.989	3 20 32	0.340	34.996	**600**
500	0 0 48	0 3 12	0 7 13	0 12 50	0 20 3	0 28 52	0 39 18	0 51 20	1 4 58	1 20 12		46.679	23.344	69.985	4 0 38	0.408	34.994	**500**
400	0 1 0	0 4 0	0 9 1	0 16 2	0 25 4	0 36 5	0 49 7	1 4 10	1 21 12	1 40 15		46 685	23.350	69.976	5 0 48	0.510	34.991	**400**
360	0 1 6	0 4 27	0 10 1	0 17 49	0 27 51	0 40 6	0 54 35	1 11 17	1 30 14	1 51 23		46.690	23.354	69.971	5 34 13	0.567	34.989	**360**
350	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34		46.691	23.356	69.969	5 43 46	0.583	34.988	**350**
300	0 1 20	0 5 20	0 12 1	0 21 23	0 33 25	0 48 7	1 5 30	1 25 33	1 48 16	2 13 40		46.700	23.364	69.958	6 41 4	0.680	34.984	**300**
250	0 1 36	0 6 25	0 14 26	0 25 40	0 40 6	0 57 45	1 18 36	1 42 40	2 9 55	2 40 24		46.715	23.377	69.939	8 1 17	0.816	34.977	**250**
230	0 1 44	0 6 58	0 15 41	0 27 54	0 43 35	1 2 46	1 25 26	1 51 35	2 21 13	2 54 20		46.723	23.385	69.928	8 43 8	0.887	34.973	**230**
200	0 2 0	0 8 1	0 18 2	0 32 5	0 50 7	1 12 11	1 38 15	2 8 19	2 42 24	3 20 28		46.741	23.402	69.904	10 1 36	1.020	34.964	**200**
170	0 2 21	0 9 26	0 21 13	0 37 44	0 58 58	1 24 55	1 55 35	2 30 58	3 11 3	3 55 50		46.770	23.428	69.868	11 47 46	1.199	34.950	**170**
155	0 2 35	0 10 21	0 23 7	0 41 24	1 4 41	1 33 8	2 6 46	2 45 34	3 29 31	4 18 38		46.791	23.447	69 841	12 56 15	1.315	34.940	**155**
125	0 3 12	0 12 50	0 28 52	0 51 20	1 20 12	1 55 29	2 37 11	3 25 17	4 19 46	5 20 38		46.858	23.509	69.754	16 2 34	1.629	34.907	**125**
100	0 4 0	0 16 2	0 36 5	1 4 10	1 40 15	2 24 21	3 16 28	4 16 34	5 24 38	6 40 39		46.965	23.609	69.615	20 3 12	2.033	34.853	**100**
90	0 4 27	0 17 49	0 40 6	1 11 17	1 51 23	2 40 24	3 38 17	4 45 3	6 0 39	7 25 3		47.034	23.675	69.523	22 16 54	2.256	34.817	**90**
80	0 5 0	0 20 3	0 45 7	1 20 12	2 5 19	3 0 26	4 5 33	5 20 38	6 45 39	8 20 31		47.131	23.767	69.395	25 4 0	2.535	34.766	**80**
70	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44		47.273	23.904	69.205	28 38 52	2.891	34.690	**70**
60	0 6 41	0 26 44	1 0 9	1 46 56	2 47 4	4 0 33	5 27 18	7 7 18	9 0 25	11 6 30		47.489	24.117	68.911	33 25 21	3.362	34.570	**60**
55	0 7 17	0 29 10	1 5 37	1 56 39	3 2 15	4 22 24	5 57 1	7 46 2	9 49 19	12 6 41		47.644	24.272	68.697	36 27 39	3.659	34.480	**55**
50	0 8 1	0 32 5	1 12 11	2 8 19	3 20 29	4 48 36	6 32 39	8 32 29	10 47 57	13 18 46		47.847	24.480	68.413	40 6 25	4.013	34.359	**50**
45	0 8 54	0 35 39	1 20 12	2 22 35	3 42 44	5 20 38	7 16 10	9 29 12	11 59 28	14 46 38		48.120	24.767	68.023	44 33 48	4.440	34.189	**45**
40	0 10 1	0 40 6	1 30 14	2 40 24	4 10 34	6 0 39	8 10 32	10 39 59	13 28 40	16 36 3		48.500	25.180	67.468	50 8 1	4.967	33.939	**40**
35	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58		49.055	25.810	66.639	57 17 44	5.629	33.549	**35**
33	0 12 9	0 48 36	1 49 22	3 14 24	5 3 39	7 16 59	9 54 9	12 54 45	16 18 11	20 3 28		49.351	26.160	66.187	60 46 5	5.944	33.328	**33**
30	0 13 22	0 53 28	2 0 18	3 33 50	5 33 59	8 0 33	10 53 15	14 11 31	17 54 31	22 0 58		49.914	26.850	65.317	66 50 42	6.404	32.889	**30**
25	0 15 2	1 4 10	2 24 21	4 16 34	6 40 39	9 36 17	13 2 55	16 59 37	21 24 52	26 16 22		51.387	28.788	63.026	80 12 50	7.618	31.644	**25**
23	0 17 26	1 9 44	2 36 54	4 38 51	7 15 24	10 26 9	14 10 22	18 26 51	23 13 36	28 27 37		52.315	30.086	61.615	87 11 21	8.188	30.818	**23**
20																		**20**
15																		**15**
14																		**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=70 metre

R_c	Length of Transition Curve to Chord Points in Metre																				R_c
	7.0		14.0		21.0		28.0		35.0		42.0		49.0		56.0		63.0		70.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	7.000	0.000	14.000	0.003	21.000	0.009	28.000	0.021	35.000	0.041	42.000	0.071	49.000	0.112	56.000	0.167	62.999	0.238	69.999	0.327	**2500**
2200	7.000	0.000	14.000	0.003	21.000	0.010	28.000	0.024	35.000	0.046	42.000	0.080	49.000	0.127	55.999	0.190	62.999	0.271	69.998	0.371	**2200**
2000	7.000	0.000	14.000	0.003	21.000	0.011	28.000	0.026	35.000	0.051	42.000	0.088	49.000	0.140	55.999	0.209	62.999	0.298	69.998	0.408	**2000**
1800	7.000	0.000	14.000	0.004	21.000	0.012	28.000	0.029	35.000	0.057	42.000	0.098	49.000	0.156	55.999	0.232	62.998	0.331	69.997	0 454	**1800**
1500	7.000	0.001	14.000	0.004	21.000	0.015	28.000	0.035	35.000	0.068	42.000	0.118	48.999	0.187	55.999	0.279	62.998	0.397	69.996	0.544	**1500**
1200	7.000	0.001	14.000	0.005	21 000	0.018	28.000	0.044	35.000	0.085	42.000	0.147	48.999	0.233	55.998	0.348	62.996	0.496	69.994	0.681	**1200**
1000	7.000	0.001	14.000	0.007	21.000	0.022	28.000	0.052	35.000	0.102	41.999	0 176	48.999	0.280	55.997	0.418	62.995	0.595	69.991	0.817	**1000**
900	7.000	0.001	14.000	0.007	21.000	0.024	28.000	0.058	35.000	0.113	41.999	0.196	48.998	0.311	55.997	0.465	62.994	0.661	69.989	0.907	**900**
800	7.000	0.001	14.000	0.008	21 000	0.028	28.000	0.065	35.000	0.128	41.999	0.220	48.998	0.350	55.996	0.523	62.992	0.744	69.987	1.021	**800**
700	7.000	0.001	14.000	0.009	21.000	0.031	28.000	0.075	34.999	0.146	41.999	0.252	48.997	0.400	55.994	0.597	62.990	0.850	69.982	1.166	**700**
600	7.000	0.001	14.000	0.011	21.000	0.037	28.000	0.087	34.999	0.170	41.998	0 294	48.996	0.467	55.992	0.697	62.986	0.992	69.976	1.361	**600**
500	7.000	0.002	14.000	0.013	21.000	0.044	28.000	0.105	34.999	0.204	41.997	0.353	48.994	0.560	55.989	0.836	62.980	1.190	69 966	1.633	**500**
400	7.000	0.002	14.000	0.016	21.000	0.055	27.999	0.131	34.998	0 255	41.996	0.441	48.991	0.700	55.982	1.045	62.968	1.488	69.946	2.041	**400**
360	7.000	0.002	14.000	0.018	21.000	0 061	27.999	0.145	34.998	0.284	41.995	0.490	48.989	0.778	55.978	1.161	62.961	1.653	69.934	2.267	**360**
350	7.000	0.002	14.000	0.019	21.000	0.063	27.999	0.149	34.998	0.292	41.995	0.504	48.988	0.800	55.977	1.194	62.959	1.700	69.930	2.332	**350**
300	7.000	0.003	14.000	0.022	21.000	0.073	27.999	0.174	34.997	0.340	41.993	0.588	48.984	0.934	55.969	1.393	62.944	1.983	69.905	2.720	**300**
250	7.000	0.003	14.000	0.026	21.000	0.088	27.999	0.209	34.996	0.408	41.989	0.705	48.977	1.120	55.955	1.672	62.919	2.379	69.863	3.262	**250**
230	7.000	0.004	14.000	0.028	21.000	0.096	27.998	0.227	34.995	0.444	41.987	0.767	48.973	1.217	55.947	1.817	62.904	2.586	69.838	3.545	**230**
200	7.000	0.004	14.000	0.033	20.999	0.110	27.998	0.261	34.993	0 510	41.983	0.882	48.964	1.400	55.930	2.089	62'874	2.972	69.786	4.074	**200**
170	7.000	0.005	14.000	0.038	20.999	0.130	27.997	0.307	34.991	0.600	41.977	1.037	48.950	1.647	55.903	2.457	62.825	3.495	69.704	4.789	**170**
155	7.000	0.005	14.000	0.042	20.999	0.142	27.996	0 337	34.989	0.658	41.972	1.138	48.940	1.806	55.883	2.694	62.790	3.832	69.644	5.250	**155**
125	7.000	0.007	14.000	0.052	20.999	0.176	27.994	0.418	34.983	0.816	41.957	1.410	48.908	2.238	55.820	3.337	62.677	4.745	69.453	6.497	**125**
100	7.000	0.008	14.000	0.065	20.998	0.220	27.991	0.523	34.973	1.020	41.933	1.762	48.856	2.795	55.720	4.166	62.496	5.919	69.147	8.095	**100**
90	7.000	0.009	14.000	0.073	20.997	0.245	27.989	0.581	34.967	1.133	41.918	1.957	48.822	3.104	55.654	4.625	62.378	6.568	68.949	8.977	**90**
80	7.000	0.010	14.000	0.082	20.997	0.276	27.986	0.653	34.958	1.275	41.896	2.201	48.775	3.490	55.563	5.197	62.213	7.375	68.672	10.070	**80**
70	7.000	0.012	13.999	0.093	20.996	0.315	27.982	0.746	34.945	1.457	41.864	2.514	48.707	3.985	55 429	5.930	61 974	8.406	68.270	11.460	**70**
60	7.000	0.014	13.999	0.109	20.994	0.367	27.976	0.871	34.926	1.699	41.815	2.931	48 601	4.641	55 225	6 900	61.608	9.765	67.655	13.284	**60**
55	7.000	0.015	13.999	0.119	20.993	0.401	27.971	0.950	34.912	1.853	41.780	3.195	48.526	5.058	55.078	7.513	61.347	10.621	67.218	14.424	**55**
50	7.000	0.016	13.999	0.131	20.992	0.441	27.965	1.044	34.893	2.037	41.734	3.512	48.427	5.555	54.886	8.244	61.005	11.636	66 647	15.770	**50**
45	7.000	0.018	13.999	0.145	20.990	0.490	27.957	1.160	34.868	2.262	41.672	3.898	48.293	6.161	54.628	9.129	60.545	12.860	65.882	17.379	**45**
40	7.000	0.020	13.998	0.163	20.987	0.551	27.945	1.305	34.833	2.543	41.585	4.379	48.107	6.912	54.269	10.222	59.908	14.358	64.827	19.327	**40**
35	7.000	0.023	13.998	0.187	20.983	0.630	27.928	1.491	34.782	2.904	41.459	4.994	47.837	7.867	53.749	11.602	58.990	16.229	63.317	21.719	**35**
33	7.000	0.025	13.997	0.198	20.981	0.668	27.919	1.581	34.755	3.078	41.392	5.290	47.693	8.326	53.474	12.260	58.507	17.112	62.525	22.829	**33**
30	7.000	0.027	13.997	0.218	20.977	0.734	27.903	1.738	34.703	3.382	41.265	5.806	47.423	9.122	52.957	13.392	57.602	18.615	61.054	24.688	**30**
25	7.009	0.033	13.996	0.261	20.967	0.881	27.860	2.083	34.574	4.048	40.946	6.929	46.744	10.834	51.668	15.790	55.366	21.714	57.469	28.369	**25**
23	7.000	0.036	13.995	0.284	20.961	0.957	27.834	2.263	34.497	4.393	40.757	7.507	46.345	11.704	50.917	16.985	54.078	23.208	55.435	30.049	**23**
20																					**20**
15																					**15**
14																					**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 75 metre

R_C	Length of Transition Curve to Chord Points in Metre											L.T.	S.T.	L.C.	Θ_s	s	K	R_C
	7.5	15.0	22.5	30.0	37.5	45.0	52.5	60.0	67.5	75.0								
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10								
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″		metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 10	0 0 41	0 1 32	0 2 45	0 4 17	0 6 11	0 8 25	0 11 0	0 13 55	0 17 11		50.001	25.001	74.999	0 51 33	0.094	37.500	2500
2200	0 0 11	0 0 46	0 1 45	0 3 7	0 4 52	0 7 1	0 9 34	0 12 30	0 15 49	0 19 31		50.001	25.001	74.999	0 58 35	0.106	37.500	2200
2000	0 0 12	0 0 51	0 1 56	0 3 26	0 5 22	0 7 44	0 10 31	0 13 45	0 17 24	0 21 29		50.001	25.001	74.999	1 4 27	0 117	37.500	2000
1800	0 0 14	0 0 57	0 2 8	0 3 49	0 5 58	0 8 35	0 11 41	0 15 16	0 19 20	0 23 52		50.001	25.001	74.999	1 11 37	0.130	37.499	1800
1500	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38		50.002	25.001	74.998	1 25 56	0.156	37.499	1500
1200	0 0 21	0 1 25	0 3 13	0 5 43	0 8 57	0 12 53	0 17 32	0 22 55	0 29 0	0 35 48		50.003	25.002	74.997	1 47 25	0.195	37.499	1200
1000	0 0 25	0 1 43	0 3 52	0 6 52	0 10 44	0 15 28	0 21 3	0 27 30	0 34 48	0 42 58		50.004	25.003	74.995	2 8 54	0.234	37.498	1000
900	0 0 28	0 1 54	0 4 17	0 7 38	0 11 56	0 17 11	0 23 23	0 30 33	0 38 40	0 47 44		50.005	25.004	74.994	2 23 14	0.260	37.498	900
800	0 0 32	0 2 8	0 4 50	0 8 35	0 13 25	0 19 20	0 26 19	0 34 22	0 43 30	0 53 42		50.006	25.005	74.993	2 41 8	0.293	37.497	800
700	0 0 36	0 2 27	0 5 31	0 9 49	0 15 20	0 22 5	0 30 4	0 39 17	0 49 43	1 1 23		50.008	25.007	74.990	3 4 9	0.335	37.496	700
600	0 0 42	0 2 51	0 6 26	0 11 27	0 17 54	0 25 46	0 35 5	0 45 50	0 58 0	1 11 37		50.010	25.009	74.987	3 34 51	0.391	37.495	600
500	0 0 51	0 3 26	0 7 44	0 13 45	0 21 29	0 30 56	0 42 6	0 55 0	1 9 36	1 25 56		50.015	25.013	74.981	4 17 49	0.469	37.493	500
400	0 1 4	0 4 17	0 9 40	0 17 11	0 26 51	0 38 40	0 52 38	1 8 45	1 27 0	1 47 25		50.023	25.021	74.971	5 22 17	0.586	37.489	400
360	0 1 11	0 4 46	0 10 44	0 19 5	0 29 50	0 42 58	0 58 29	1 16 23	1 36 40	1 59 21		50.028	25.026	74.964	5 58 5	0.651	37.486	360
350	0 1 13	0 4 54	0 11 2	0 19 38	0 30 41	0 44 11	1 0 9	1 18 34	1 39 26	2 2 45		50.030	25.027	74.962	6 8 19	0.669	37.486	350
300	0 1 25	0 5 43	0 12 53	0 22 55	0 35 48	0 51 33	1 10 11	1 31 40	1 56 0	2 23 13		50.041	25.037	74.948	7 .9 43	0.781	37.480	300
250	0 1 43	0 6 52	0 15 28	0 27 30	0 42 58	1 1 52	1 24 13	1 49 59	2 19 12	2 51 51		50.059	25.054	74.925	8 35 39	0.937	37.472	250
230	0 1 52	0 7 28	0 16 48	0 29 53	0 46 42	1 7 15	1 31 32	1 59 33	2 31 18	3 6 47		50.070	25.063	74.911	9 20 30	1.018	37.467	230
200	0 2 8	0 8 35	0 19 20	0 34 22	0 53 42	1 17 20	1 45 16	2 17 29	2 54 0	3 34 47		50.092	25.084	74.882	10 44 34	1.170	37.456	200
170	0 2 31	0 10 6	0 22 44	0 40 26	1 3 11	1 30 59	2 3 50	2 41 44	3 24 41	4 12 40		50.127	25.116	74.837	12 38 19	1.376	37.438	170
155	0 2 46	0 11 5	0 24 57	0 44 21	1 9 18	1 39 47	2 15 49	2 57 23	3 44 29	4 37 6		50.153	25.140	74.804	13 51 42	1.509	37.426	155
125	0 3 26	0 13 45	0 30 56	0 55 0	1 25 56	2 3 44	2 48 25	3 39 56	4 38 19	5 43 30		50.235	25.216	74.698	17 11 19	1.869	37.385	125
100	0 4 17	0 17 11	0 38 40	1 8 45	1 47 25	2 34 40	3 30 30	4 34 53	5 47 47	7 9 12		50.366	25.340	74.526	21 29 9	2.332	37.318	100
90	0 4 46	0 19 5	0 42 58	1 16 23	1 59 21	2 51 51	3 53 52	5 5 23	6 26 22	7 56 45		50.452	25.421	74.413	23 52 23	2.588	37.274	90
80	0 5 22	0 21 29	0 48 20	1 25 56	2 14 16	3 13 19	4 23 5	5 43 30	7 14 33	8 56 8		50.571	25.535	74.254	26 51 26	2.907	37.210	80
70	0 6 8	0 24 33	0 55 14	1 38 12	2 33 26	3 40 55	5 0 37	6 32 29	8 16 26	10 12 22		50.744	25.704	74.020	30 41 39	3.314	37.116	70
60	0 7 9	0 28 38	1 4 27	1 54 34	2 59 0	4 17 43	5 50 39	7 37 44	9 38 51	11 53 48		51.010	25.969	73.655	35 48 35	3.852	36.964	60
55	0 7 48	0 31 15	1 10 18	2 4 59	3 15 16	4 41 7	6 22 28	8 19 13	10 31 12	12 58 11		51.200	26.163	73.390	39 3 55	4.191	36.852	55
50	0 8 35	0 34 22	1 17 20	2 17 29	3 34 47	5 9 12	7 0 38	9 8 57	11 33 56	14 15 17		51.449	26.422	73.037	42 58 18	4.594	36.699	50
45	0 9 32	0 38 11	1 25 56	2 32 45	3 58 38	5 43 30	7 47 15	10 9 40	12 50 28	15 49 13		51.784	26.781	72.552	47 44 47	5.081	36.484	45
40	0 10 44	0 42 58	1 36 40	2 51 51	4 28 26	6 26 22	8 45 27	11 25 26	14 25 52	17 46 7		52.251	27.301	71.861	53 42 53	5.679	36.165	40
35	0 12 16	0 49 6	1 50 29	3 16 23	5 6 45	7 21 26	10 0 11	13 2 36	16 28 1	20 15 29		52.934	28.099	70.825	61 23 18	6.428	35.664	35
33	0 13 1	0 52 5	1 57 11	3 28 17	5 25 19	7 48 7	10 36 22	13 49 36	17 27 2	21 27 29		53.300	28.546	70.261	65 6 32	6.784	35.380	33
30	0 14 19	0 57 17	2 8 54	3 49 6	5 57 48	8 34 46	11 39 37	15 11 41	19 9 55	23 32 42		54.001	29.432	69.171	71 37 11	7.391	34.812	30
25	0 17 11	1 8 45	2 34 40	4 34 53	7 9 12	10 17 15	13 58 20	18 11 18	22 54 15	28 4 18		55.864	31.968	66.297	85 56 37	8.656	33.188	25
23																		23
20																		20
15																		15
14																		14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 75 metre

R_C	Length of Transition Curve to Chord Points in Metre																				R_C
	7.5		15.0		22.5		30.0		37.5		45.0		52.5		60.0		67.5		75.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	7.500	0.000	15.000	0.003	22.500	0.010	30.000	0.024	37.500	0.047	45.000	0.081	52.500	0.129	59.999	0.192	67.499	0.273	74.998	0.375	**2500**
2200	7.500	0.000	15.000	0.003	22.500	0.012	30.000	0.027	37.500	0.053	45.000	0.092	52.500	0.146	59.999	0.218	67.499	0.311	74.998	0.426	**2200**
2000	7.500	0.000	15.000	0.004	22.500	0.013	30.000	0.030	37.500	0.059	45.000	0.101	52.500	0.161	59.999	0.240	67.498	0.342	74.997	0.469	**2000**
1800	7.500	0.001	15.000	0.004	22.500	0.014	30.000	0.033	37.500	0.065	45.500	0.112	52.499	0.179	59.999	0.267	67.498	0.380	74.997	0.521	**1800**
1500	7.500	0.001	15.000	0.005	22.500	0.017	30.000	0.040	37.500	0.078	45.000	0.135	52.499	0.214	59.998	0.320	67.497	0.456	74.995	0.625	**1500**
1200	7.500	0.001	15.000	0.006	22.500	0.021	30.000	0.050	37.500	0.098	44.999	0.169	52.499	0.268	59.998	0.400	67.496	0.570	74.993	0.781	**1200**
1000	7.500	0.001	15.000	0.008	22.500	0.025	30.000	0.060	37.500	0.117	44.999	0.202	52.498	0.322	59.997	0.480	67.494	0.683	74.989	0.937	**1000**
900	7.500	0.001	15.000	0.008	22.500	0.028	30.000	0.067	37.500	0.130	44.999	0.225	52.498	0.357	59.996	0.533	67.492	0.759	74.987	1.042	**900**
800	7.500	0.001	15.000	0.009	22.500	0.032	30.000	0.075	37.499	0.146	44.999	0.253	52.497	0.402	59.995	0.600	67.490	0.854	74.984	1.172	**800**
700	7.500	0.001	15.000	0.011	22.500	0.036	30.000	0.086	37.499	0.167	44.998	0.289	52.496	0.459	59.993	0.686	67.487	0.976	74.978	1.339	**700**
600	7.500	0.002	15.000	0.012	22.500	0.042	30.000	0.100	37.499	0.195	44.998	0.337	52.495	0.536	59.990	0.800	67.483	1.139	74.971	1.562	**600**
500	7.500	0.002	15.000	0.015	22.500	0.051	30.000	0.120	37.499	0.234	44.997	0.405	52.493	0.643	59.986	0.960	67.475	1.367	74.958	1.874	**500**
400	7.500	0.002	15.000	0.019	22.500	0.063	29.999	0.150	37.498	0.293	44.995	0.506	52.489	0.804	59.978	1.200	67.461	1.708	74.934	2.342	**400**
360	7.500	0.003	15.000	0.021	22.500	0.070	29.999	0.167	37.497	0.326	44.994	0.562	52.486	0.893	59.973	1.333	67.452	1.897	74.919	2.602	**360**
350	7.500	0.003	15.000	0.021	22.500	0.072	29.999	0.171	37.497	0.333	44.993	0.579	52.486	0.919	59.972	1.371	67.449	1.952	74.914	2.676	**350**
300	7.500	0.003	15.000	0.025	22.500	0.084	29.999	0.200	37.496	0.391	44.991	0.675	52.480	1.072	59.962	1 599	67.431	2 276	74.883	3.122	**300**
250	7.500	0.004	15.000	0.030	22.500	0.101	29.998	0.240	37.495	0.469	44.987	0.810	52.472	1.286	59.945	1.919	67.400	2.731	74.831	3.744	**250**
230	7.500	0.004	15.000	0.033	22.500	0.110	29.998	0.261	37.494	0.509	44.984	0.880	52.467	1.397	59.935	2.085	67.382	2.968	74.801	4.068	**230**
200	7.500	0.005	15.000	0.037	22.499	0.127	29.997	0.300	37.492	0.586	44.980	1.012	52.456	1.607	59.914	2.398	67.344	3.412	74.737	4.676	**200**
170	7.500	0.006	15.000	0.044	22.499	0.149	29.996	0.353	37.489	0.689	44.972	1.191	52.439	1.890	59.881	2.820	67.285	4.011	74.636	5.496	**170**
155	7.500	0.006	15.000	0.048	22.499	0.163	29.995	0.387	37.486	0.756	44.966	1.306	52.426	2.073	59.856	3.091	67.241	4.397	74.562	6 023	**155**
125	7.500	0.007	15.000	0.060	22 498	0.202	29.993	0.480	37.479	0.937	44.948	1.619	52.387	2.569	59.779	3.830	67.103	5.444	74.328	7.452	**125**
100	7.500	0.009	15.000	0.075	22.497	0.253	29.989	0.600	37.467	1.171	44.918	2.022	52.323	3 208	59.655	4.780	66.880	6.789	73.952	9.281	**100**
90	7.500	0.010	15.000	0 083	22.497	0.281	29.987	0.666	37.459	1.301	44.899	2.246	52.282	3.562	59.575	5.306	66.735	7.532	73.708	10.288	**90**
80	7.500	0.012	14.999	0.094	22.496	0.316	29 983	0.750	37.449	1.463	44.872	2.526	52.224	4.004	59.462	5.962	66.533	8.455	73.369	11.536	**80**
70	7.500	0 013	14.999	0.107	22.495	0.362	29.978	0.857	37.433	1.672	44.833	2.885	52.139	4.571	59.299	6.800	66 240	9.633	72.876	13.121	**70**
60	7.500	0.016	14.999	0.125	22.493	0.422	29.970	0.999	37.409	1.950	44.773	3.363	52.010	5.324	59.047	7.909	65.790	11.184	72.123	15.194	**60**
55	7.500	0.017	14.999	0.136	22.492	0.460	29.964	1.090	37.391	2.126	44.730	3.666	51.917	5.800	58.868	8.609	65.470	12.158	71.588	16.488	**55**
50	7.500	0.019	14.999	0.150	22.490	0.506	29.957	1.199	37.368	2.338	44.673	4.029	51.795	6.369	58.632	9.443	65.051	13.313	70.890	18.010	**50**
45	7.500	0.021	14.998	0.167	22.487	0.562	29.947	1.332	37.338	2.596	44.597	4.471	51.631	7 061	58.316	10.452	64.489	14.700	69.956	19.822	**45**
40	7.500	0.023	14.998	0.187	22.484	0.632	29.933	1.498	37.295	2.918	44.490	5.021	51 403	7.919	57.876	11.695	63.710	16.395	68.671	22.007	**40**
35	7.500	0.027	14.997	0.214	22.479	0.723	29.912	1.711	37.232	3.331	44.335	5.725	51.071	9.008	57.240	13.261	62.590	18.501	66.836	24.668	**35**
33	7.500	0.028	14.997	0.227	22.476	0.766	29 901	1.814	37.198	3.531	44.253	6.063	50.895	9.531	56.903	14.005	62.001	19.490	65.877	25.894	**33**
30	7.500	0.031	14.996	0.250	22.472	0.843	29.880	1.994	37.135	3.879	44 097	6.653	50.564	10.435	56.272	15.283	60.901	21.167	64.098	27.931	**30**
25	7.500	0.037	14.995	0.300	22.459	1.011	29.828	2.390	36.976	4.641	43.705	7.933	49.734	12.375	54.701	17.973	58.193	24.587	59.792	31.888	**25**
23																					**23**
20																					**20**
15																					**15**
14																					**14**

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 80 metre

R_C	Length of Transition Curve to Chord Points in Metre										L.T.	S.T.	L.C.	Θ_s	s	K	R_C
	8.0	16.0	24.0	32.0	40.0	48.0	56.0	64.0	72.0	80.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 11	0 0 44	0 1 39	0 2 56	0 4 35	0 6 36	0 8 59	0 11 44	0 14 51	0 18 20	53.334	26.667	79.999	0 55 0	0.107	40.000	**2500**
2200	0 0 12	0 0 50	0 1 52	0 3 20	0 5 12	0 7 30	0 10 12	0 13 20	0 16 52	0 20 50	53.334	26.668	79.999	1 2 30	0.121	40.000	**2200**
2000	0 0 13	0 0 55	0 2 3	0 3 40	0 5 43	0 8 15	0 11 13	0 14 40	0 18 33	0 22 55	53.334	26.668	79.999	1 8 45	0.133	39.999	**2000**
1800	0 0 15	0 1 1	0 2 17	0 4 4	0 6 21	0 9 10	0 12 28	0 16 17	0 20 37	0 25 27	53 335	26.668	79.998	1 16 23	0.148	39.999	**1800**
1500	0 0 18	0 1 13	0 2 45	0 4 53	0 7 38	0 11 0	0 14 58	0 19 33	0 24 45	0 30 33	53.335	26.668	79.997	1 31 40	0.178	39.999	**1500**
1200	0 0 22	0 1 31	0 3 26	0 6 6	0 9 32	0 13 45	0 18 42	0 24 26	0 30 56	0 38 11	53.336	26.669	79.996	1 54 35	0.222	39.999	**1200**
1000	0 0 27	0 1 50	0 4 7	0 7 20	0 11 27	0 16 30	0 22 27	0 29 20	0 37 7	0 45 50	53.338	26.671	79.994	2 17 30	0.267	39.998	**1000**
900	0 0 30	0 2 2	0 4 35	0 8 8	0 12 43	0 18 20	0 24 57	0 32 35	0 41 15	0 50 55	53.339	26.672	79.993	2 32 47	0.296	39.997	**900**
800	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17	53.340	26.673	79.991	2 51 53	0.333	39.997	**800**
700	0 0 39	0 2 37	0 5 53	0 10 28	0 16 22	0 23 34	0 32 5	0 41 54	0 53 2	1 5 28	53.342	26.675	79.988	3 16 26	0.381	39.996	**700**
600	0 0 45	0 3 3	0 6 52	0 12 13	0 19 5	0 27 30	0 37 25	0 48 53	1 1 52	1 16 23	53.346	26.678	79.984	3 49 10	0.444	39.994	**600**
500	0 0 55	0 3 40	0 8 15	0 14 40	0 22 55	0 33 0	0 44 55	0 58 40	1 14 15	1 31 40	53 351	26.683	79.977	4 35 1	0.533	39.991	**500**
400	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34	53.361	26.692	79.964	5 43 46	0.666	39.987	**400**
360	0 1 16	0 5 5	0 11 27	0 20 22	0 31 49	0 45 50	1 2 23	1 21 29	1 43 7	2 7 18	53.368	26.698	79.956	6 21 58	0.740	39.984	**360**
350	0 1 18	0 5 14	0 11 47	0 20 57	0 32 44	0 47 8	1 4 10	1 23 48	1 46 4	2 10 56	53.370	26.700	79.954	6 32 53	0.762	39.983	**350**
300	0 1 31	0 6 6	0 13 45	0 24 26	0 38 11	0 55 0	1 14 51	1 37 46	2 3 44	2 32 45	53.383	26.712	79.937	7 38 21	0.888	39.976	**300**
250	0 1 50	0 7 20	0 16 30	0 29 20	0 45 50	1 6 0	1 29 50	1 57 19	2 28 29	3 3 18	53.405	26.732	79.909	9 10 2	1.066	39.966	**250**
230	0 1 59	0 7 58	0 17 56	0 31 53	0 49 49	1 11 44	1 37 38	2 7 31	2 41 23	3 19 14	53.418	26.744	79.892	9 57 52	1.158	39.959	**230**
200	0 2 17	0 9 10	0 20 37	0 36 40	0 57 17	1 22 30	1 52 17	2 26 39	3 5 35	3 49 6	53.445	26.769	79.857	11 27 32	1.331	39.946	**200**
170	0 2 41	0 10 47	0 24 15	0 43 8	1 7 24	1 37 3	2 12 6	2 52 31	3 38 19	4 29 30	53.488	26.808	79.802	13 28 52	1.566	39.925	**170**
155	0 2 57	0 11 49	0 26 36	0 47 18	1 13 55	1 46 27	2 24 53	3 9 13	3 59 26	4 55 33	53.519	26.837	79.762	14 47 9	1.716	39.910	**155**
125	0 3 40	0 14 40	0 33 0	0 58 40	1 31 40	2 11 59	2 59 38	3 54 36	4 56 51	6 6 22	53.618	26.930	79.633	18 20 4	2.126	39.860	**125**
100	0 4 35	0 18 20	0 41 15	1 13 20	1 54 34	2 44 58	3 44 31	4 53 11	6 10 56	7 37 44	53.778	27.080	79.423	22 55 6	2.651	39.778	**100**
90	0 5 5	0 20 22	0 45 50	1 21 29	2 7 18	3 3 18	4 9 27	5 25 43	6 52 4	8 28 26	53.881	27.179	79.286	25 27 53	2.942	39.724	**90**
80	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	54.026	27.318	79.092	28 38 52	3.304	39.646	**80**
70	0 6 32	0 26 11	0 58 55	1 44 45	2 43 40	3 55 38	5 20 38	6 58 36	8 49 25	10 52 59	54.236	27.525	78.807	32 44 25	3.765	39.529	**70**
60	0 7 38	0 30 33	1 8 45	2 2 13	3 10 56	4 34 53	6 13 59	8 8 10	10 17 15	12 41 2	54.558	27.850	78.360	38 11 49	4.375	39.342	**60**
55	0 8 20	0 33 20	1 15 0	2 13 19	3 28 17	4 59 50	6 47 55	8 52 23	11 13 2	13 49 36	54.788	28.087	78.036	41 40 10	4.758	39.203	**55**
50	0 9 10	0 36 40	1 22 30	2 26 39	3 49 6	5 29 47	7 28 36	9 45 23	12 19 53	15 11 41	55.089	28.407	77.603	45 50 11	5.213	39.012	**50**
45	0 10 11	0 40 44	1 31 40	2 42 56	4 14 32	6 6 22	8 18 18	10 50 5	13 41 23	16 51 38	55.495	28.851	77.009	50 55 46	5.761	38.742	**45**
40	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58	56.062	29.498	76.158	57 17 44	6.434	38.341	**40**
35	0 13 5	0 52 23	1 57 51	3 29 28	5 27 10	7 50 47	10 39 59	13 54 18	17 32 56	21 34 40	56.894	30.499	74.882	65 28 51	7.273	37.707	**35**
33	0 13 53	0 55 33	2 4 59	3 42 10	5 46 58	8 19 13	11 18 33	14 44 21	18 35 40	22 51 5	57.342	31.062	74.186	69 26 58	7.670	37.346	**33**
30	0 15 16	1 1 6	2 17 29	4 4 22	6 21 36	9 8 57	12 25 55	16 11 42	20 25 1	25 3 52	58.205	32.191	72.840	76 23 39	8.345	36.620	**30**
25																	**25**
23																	**23**
20																	**20**
15																	**15**
14																	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 80 metre

R_C	Length of Transition Curve to Chord Points in Metre																		R_C		
	8.0		16.0		24.0		32.0		40.0		48.0		56.0		64.0		72.0		80.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	8.000	0.000	16.000	0.003	24.000	0.012	32.000	0.027	40.000	0.053	48.000	0.092	56.000	0.146	63.999	0.218	71.999	0.311	79.998	0.427	2500
2200	8.000	0.000	16.000	0.004	24.000	0.013	32.000	0.031	40.000	0.061	48.000	0.105	56.000	0.166	63.999	0.248	71.998	0.353	79.997	0.485	2200
2000	8.000	0.001	16.000	0.004	24.000	0.014	32.000	0.034	40.000	0.067	48.000	0.115	55.999	0.183	63.999	0.273	71.998	0.389	79.997	0.533	2000
1800	8.000	0.001	16.000	0.005	24.000	0.016	32.000	0.038	40.000	0.074	48.000	0.128	55.999	0.203	63.999	0.303	71.998	0.432	79.996	0.593	1800
1500	8.000	0.001	16.000	0.006	24.000	0.019	32.000	0.046	40.000	0.089	48.000	0.154	55.999	0.244	63.998	0.364	71.997	0.518	79.994	0.711	1500
1200	8.000	0.001	16.000	0.007	24.000	0.024	32.000	0.057	40.000	0.111	47.999	0.192	55.999	0.305	63.997	0.455	71.995	0.648	79.991	0.889	1200
1000	8.000	0.001	16.000	0.009	24.000	0.029	32.000	0.068	40.000	0.133	47.999	0.230	55.998	0.366	63.996	0.546	71.992	0.778	79.987	1.067	1000
900	8.000	0.001	16.000	0.009	24.000	0.032	32.000	0.076	40.000	0.148	47.999	0.256	55.997	0.407	63.995	0.607	71.991	0.864	79.984	1.185	900
800	8.000	0.001	16.000	0.011	24.000	0.036	32.000	0.085	39.999	0.167	47.998	0.288	55.997	0.457	63.993	0.683	71.988	0.572	79.980	1.333	800
700	8.000	0.002	16.000	0.012	24.000	0.041	32.000	0.098	39.999	0.190	47.998	0.329	55.996	0.523	63.991	0.780	71.985	1.111	79.974	1.523	700
600	8.000	0.002	16.000	0.014	24.000	0.048	32.000	0.114	39.999	0.222	47.997	0.384	55.994	0.610	63.988	0.910	71.979	1.296	79.964	1.777	600
500	8.000	0.002	16.000	0.017	24.000	0.058	31.999	0.137	39.998	0.267	47.996	0.461	55.991	0.732	63.983	1.092	71.970	1.555	79.949	2.132	500
400	8.000	0.003	16.000	0.021	24.000	0.072	31.999	0.171	39.997	0.333	47.994	0.576	55.987	0.915	63.974	1.365	71.953	1.943	79.920	2.665	400
360	8.000	0.003	16.000	0.024	24.000	0.080	31.999	0.190	39.997	0.370	47.992	0.640	55.983	1.016	63.968	1.516	71.942	2.159	79.901	2.960	360
350	8.000	0.003	16.000	0.024	24.000	0.082	31.999	0.195	39.997	0.381	47.992	0.658	55.982	1.045	63.966	1.560	71.938	2.220	79.896	3.045	350
300	8.000	0.004	16.000	0.028	24.000	0.096	31.999	0.228	39.996	0.444	47.989	0.768	55.976	1.219	63.953	1.819	71.916	2.590	79.858	3.551	300
250	8.000	0.004	16.000	0.034	23.999	0.115	31.998	0.273	39.994	0.533	47.984	0.921	55.966	1.463	63.933	2.183	71.879	3.107	79.795	4.259	250
230	8.000	0.005	16.000	0.037	23.999	0.125	31.998	0.297	39.992	0.580	47.981	1.001	55.959	1.590	63.921	2.372	71.857	3.376	79.758	4.628	230
200	8.000	0.005	16.000	0.043	23.999	0.144	31.997	0.341	39.990	0.667	47.975	1.152	55.946	1.828	63.895	2.727	71.811	3.881	79.681	5.318	200
170	8.000	0.006	16.000	0.050	23.999	0.169	31.995	0.402	39.986	0.784	47.966	1.355	55.926	2.150	63.855	3.207	71.739	4.562	79.558	6.250	170
155	8.000	0.007	16.000	0.055	23.999	0.186	31.995	0.440	39.983	0.860	47.959	1.486	55.911	2.358	63.826	3.517	71.686	5.001	79.469	6.849	155
125	8.000	0.009	16.000	0.068	23.998	0.230	31.992	0.546	39.974	1.066	47.936	1.841	55.862	2.922	63.732	4.356	71.518	6.191	79.185	8.471	125
100	8.000	0.011	16.000	0.085	23.997	0.288	31.987	0.682	39.960	1.332	47.901	2.301	55.785	3.649	63.582	5.436	71.248	7.718	78.729	10.545	100
90	8.000	0.012	15.999	0.095	23.996	0.320	31.984	0.758	39.951	1.480	47.877	2.555	55.735	4.051	63.484	6.033	71.072	8.560	78.434	11.686	90
80	8.000	0.013	15.999	0.107	23.995	0.360	31.980	0.853	39.938	1.665	47.845	2.873	55.665	4.554	63.348	6.777	70.828	9.607	78.023	13.097	80
70	8.000	0.015	15.999	0.122	23.994	0.411	31.973	0.975	39.918	1.902	47.797	3.281	55.563	5.197	63.149	7.728	70.473	10.940	77.427	14.886	70
60	8.000	0.018	15.999	0.142	23.991	0.480	31.964	1.137	39.889	2.218	47.724	3.824	55.405	6.051	62.845	8.985	69.929	12.693	76.517	17.221	60
55	8.000	0.019	15.999	0.155	23.990	0.523	31.957	1.240	39.868	2.419	47.672	4.169	55.293	6.592	62.627	9.777	69.541	13.792	75.871	18.673	55
50	8.000	0.021	15.998	0.171	23.988	0.576	31.948	1.364	39.840	2.659	47.603	4.581	55.146	7.237	62.343	10.720	69.035	15.092	75.029	20.378	50
45	8.000	0.024	15.998	0.190	23.985	0.640	31.935	1.515	39.803	2.953	47.511	5.083	54.947	8.021	61.960	11.859	68.356	16.651	73.906	22.399	45
40	8.000	0.027	15.997	0.213	23.981	0.720	31.918	1.704	39.751	3.318	47.382	5.707	54.670	8.991	61.428	13.259	67.417	18.548	72.362	24.821	40
35	8.000	0.030	15.997	0.244	23.975	0.822	31.893	1.946	39.675	3.787	47.194	6.504	54.269	10.222	60.660	15.018	66.070	20.894	70.164	29.086	35
33	8.000	0.032	15.996	0.259	23.971	0.872	31.880	2.063	39.634	4.014	47.094	6.887	54.057	10.811	60.254	15.852	65.362	21.990	69 018	29.086	33
30	8.000	0.036	15.995	0.284	23.965	0.959	31.855	2.268	39.558	4.409	46.906	7.555	53.656	11.829	59.494	17.279	64.043	23.839	66.900	31.288	30
25																					25
23																					23
20																					20
15																					15
14																					14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_C	Length of Transition Curve to Chord Points in Metre										L. T.	S. T	L. C.	Θ_s	s	K	R_C
	8.5	17.0	25.5	34.0	42.5	51.0	59.5	68.0	76.5	85.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 11	0 0 46	0 1 45	0 3 7	0 4 52	0 7 0	0 9 32	0 12 28	0 15 46	0 19 28	56.668	28.334	84.999	0 58 26	0.120	42.500	2500
2200	0 0 13	0 0 53	0 1 59	0 3 32	0 5 32	0 7 58	0 10 50	0 14 10	0 17 55	0 22 8	56.668	28.334	84.999	1 6 24	0.137	42.499	2200
2000	0 0 14	0 0 58	0 2 11	0 3 53	0 6 5	0 8 45	0 11 55	0 15 35	0 19 43	0 24 21	56.668	28.335	84.998	1 13 3	0.150	42.499	2000
1800	0 0 16	0 1 4	0 2 26	0 4 19	0 6 45	0 9 44	0 13 15	0 17 18	0 21 54	0 27 3	56.668	28.335	84.998	1 21 10	0.167	42.499	1800
1500	0 0 19	0 1 17	0 2 55	0 5 11	0 8 7	0 11 41	0 15 54	0 20 46	0 26 17	0 32 28	56.669	28.336	84.997	1 37 24	0.201	42.499	1500
1200	0 0 24	0 1 37	0 3 39	0 6 29	0 10 8	0 14 36	0 19 53	0 25 58	0 32 52	0 40 35	56.670	28.337	84.995	2 1 45	0.251	42.498	1200
1000	0 0 29	0 1 56	0 4 22	0 7 47	0 12 10	0 17 31	0 23 51	0 31 10	0 39 26	0 48 42	56.672	28.338	84.993	2 26 6	0.301	42.497	1000
900	0 0 32	0 2 9	0 4 52	0 8 39	0 13 31	0 19 28	0 26 30	0 34 37	0 43 49	0 54 6	56.673	28.339	84.992	2 42 20	0.334	42.497	900
800	0 0 36	0 2 26	0 5 28	0 9 44	0 15 13	0 21 54	0 29 49	0 38 57	0 49 18	1 0 52	56.675	28.341	84.989	3 2 37	0.376	42.496	800
700	0 0 41	0 2 46	0 6 15	0 11 7	0 17 23	0 25 2	0 34 5	0 44 31	0 56 21	1 9 34	56.678	28.343	84.986	3 28 43	0.430	42.495	700
600	0 0 48	0 3 14	0 7 18	0 12 59	0 20 17	0 29 13	0 39 46	0 51 56	1 5 44	1 21 9	56.682	28.347	84.981	4 3 30	0.502	42.493	600
500	0 0 58	0 3 53	0 8 45	0 15 35	0 24 21	0 35 3	0 47 43	1 2 20	1 18 53	1 37 23	56.688	28.353	84.973	4 52 12	0.602	42.490	500
400	0 1 13	0 4 52	0 10 57	0 19 28	0 30 26	0 43 49	0 59 39	1 17 55	1 38 36	2 1 44	56.700	28.364	84.957	6 5 15	0.752	42.484	400
360	0 1 21	0 5 24	0 12 10	0 21 38	0 33 49	0 48 42	1 6 17	1 26 34	1 49 34	2 15 15	56.708	28.371	84.947	6 45 50	0.836	42.480	360
350	0 1 23	0 5 33	0 12 31	0 22 15	0 34 47	0 50 5	1 8 10	1 29 2	1 52 41	2 19 7	56.710	28.373	84.944	6 57 26	0.860	42.479	350
300	0 1 37	0 6 29	0 14 36	0 25 58	0 40 35	0 58 26	1 19 32	1 43 53	2 11 28	2 42 18	56.726	28.388	84.924	8 7 0	1.003	42.471	300
250	0 1 56	0 7 47	0 17 31	0 31 10	0 48 42	1 10 7	1 35 26	2 4 39	2 37 46	3 14 45	56.752	28.412	84.891	9 44 25	1.203	42.459	250
230	0 2 7	0 8 28	0 19 3	0 33 52	0 52 56	1 16 13	1 43 44	2 15 30	2 51 28	3 31 41	56.768	28.426	84.871	10 35 14	1.307	42.451	230
200	0 2 26	0 9 44	0 21 54	0 38 57	1 0 52	1 27 39	1 59 18	2 35 49	3 17 11	4 3 24	56.800	28.456	84.829	12 10 31	1.503	42.435	200
170	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	56 852	28.503	84.763	14 19 26	1.767	42.410	170
155	0 3 8	0 12 34	0 28 16	0 50 16	1 18 32	1 53 6	2 33 56	3 21 2	4 14 23	5 14 0	56.889	28.538	84.714	15 42 36	1.937	42.391	155
125	0 3 53	0 15 35	0 35 3	1 2 20	1 37 23	2 20 14	3 10 51	4 9 15	5 15 22	6 29 13	57.008	28.649	84.559	19 28 50	2.398	42.332	125
100	0 4 52	0 19 28	0 43 49	1 17 55	2 1 44	2 55 17	3 58 32	5 11 29	6 34 5	8 6 15	57.199	28.830	84.307	24 21 2	2.991	42.233	100
90	0 5 24	0 21 38	0 48 42	1 26 34	2 15 15	3 14 45	4 25 1	5 46 3	7 17 46	9 0 6	57.324	28.949	84.141	27 3 22	3.318	42.167	90
80	0 6 5	0 24 21	0 54 47	1 37 23	2 32 10	3 39 5	4 58 7	6 29 13	8 12 19	10 7 18	57.497	29.118	83.908	30 26 18	3.725	42.072	80
70	0 6 57	0 27 49	1 2 36	1 51 18	2 53 53	4 10 21	5 40 39	7 24 41	9 22 23	11 33 32	57.748	29.367	83.564	34 47 12	4.244	41.930	70
60	0 8 7	0 32 28	1 13 2	2 9 51	3 22 52	4 52 2	6 37 19	8 38 34	10 55 37	13 28 12	58.133	29.761	83.024	40 35 4	4.928	41.701	60
55	0 8 51	0 35 25	1 19 41	2 21 39	3 41 18	5 18 33	7 13 21	9 25 31	11 54 50	14 40 56	58.408	30.050	82.632	44 16 26	5.358	41.530	55
50	0 9 44	0 38 57	1 27 39	2 35 49	4 3 24	5 50 22	7 56 34	10 21 48	13 5 45	16 7 57	58.769	30.440	82.108	48 42 5	5.868	41.295	50
45	0 10 49	0 43 17	1 37 23	2 53 7	4 30 26	6 29 13	8 49 20	11 30 28	14 32 13	17 53 54	59.256	30.984	81.386	54 6 45	6.481	40.960	45
40	0 12 10	0 48 42	1 49 34	3 14 45	5 4 12	7 17 46	9 55 12	12 56 8	16 19 54	20 5 34	59.937	31.780	80.353	60 52 36	7.230	40.461	40
35	0 13 54	0 55 39	2 5 13	3 42 33	5 47 35	8 20 6	11 19 45	14 45 55	18 37 38	22 53 27	60.941	33.023	78.798	69 34 24	8.162	39.668	35
33	0 14 45	0 59 1	2 12 48	3 56 2	6 8 37	8 50 18	12 0 40	15 38 59	19 44 5	24 14 13	61.486	33.729	77.949	73 47 24	8.601	39.214	33
30	0 16 14	1 4 56	2 26 5	4 19 37	6 45 24	9 43 7	13 12 10	17 11 35	21 39 48	26 34 25	62.544	35.156	76 307	81 10 8	9.345	38.297	30
25																	25
23																	23
20																	20
15																	15
14																	14

L_S = 85 metre

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

L_s = 85 metre

R_C	Length of Transition Curve to Chord Points in Metre																				R_C
	8.5		17.0		25.5		34.0		42.5		51.0		59.5		68.0		76.5		85.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	8.500	0.000	17.000	0.004	25.500	0.013	34.000	0.031	42.500	0.060	51.000	0.104	59.500	0.165	67.999	0.247	76.499	0.351	84.998	0.482	2500
2200	8.500	0.001	17.000	0.004	25.500	0.015	34.000	0.035	42.500	0.068	51.000	0.118	59.499	0.188	67.999	0.280	76.498	0.399	84.997	0.547	2200
2000	8.500	0.001	17.000	0.005	25.500	0.016	34.000	0.039	42.500	0.075	51.000	0.130	59.499	0.207	67.999	0.308	76.498	0.439	84.996	0.602	2000
1800	8.500	0.001	17.000	0.005	25.500	0.018	24.000	0.043	42.500	0.084	51.000	0.144	59.499	0.229	67.998	0.343	76.497	0.488	84.995	0.669	1800
1500	8.500	0.001	17.000	0.006	25.500	0.022	34.000	0.051	42.500	0.100	50.999	0.173	59.499	0.275	67.998	0.411	76.496	0.585	84.993	0.803	1500
1200	8.500	0.001	17.000	0.008	25.500	0.027	34.000	0.064	42.500	0.125	50.999	0.217	59.498	0.344	67.997	0.514	76.494	0.731	84.989	1.003	1200
1000	8.500	0.001	17.000	0.010	25.500	0.033	34.000	0.077	42.500	0.151	50.999	0.260	59.497	0.413	67.995	0.617	76.491	0.878	84.985	1.204	1000
900	8.500	0.001	17.000	0.011	25.500	0.036	34.000	0.086	42.499	0.167	50.999	0.289	59.497	0.459	67.994	0.685	76.489	0.975	84.981	1.338	900
800	8.500	0.002	17.000	0.012	25.500	0.041	34.000	0.096	42.499	0.188	50.998	0.325	59.496	0.516	67.992	0.771	76.486	1.097	84.976	1.505	800
700	8.500	0.002	17.000	0.014	25.500	0.046	34.000	0.110	42.499	0.215	50.998	0.372	59.495	0.590	67.990	0.881	76.481	1.254	84.969	1.720	700
600	8.500	0.002	17.000	0.016	25.500	0.054	34.000	0.128	42.499	0.251	50.997	0.433	59.493	0.688	67.986	1.027	76.475	1.463	84.957	2.006	600
500	8.500	0.002	17.000	0.019	25.500	0.065	33.999	0.154	42.498	0.301	50.995	0.520	59.490	0.826	67.980	1.233	76.464	1.755	84.939	2.407	500
400	8.500	0.003	17.000	0.024	25.500	0.081	33.999	0.193	42.497	0.376	50.993	0.650	59.484	1.032	67.969	1.541	76.443	2.193	84.904	3.008	400
360	8.500	0.003	17.000	0.027	25.500	0.090	33.999	0.214	42.496	0.418	50.991	0.722	59.480	1.147	67.961	1.712	76.430	2.437	84.882	3.342	360
350	8.500	0.003	17.000	0.028	25.500	0.093	33.999	0.220	42.496	0.430	50.990	0.743	59.479	1.180	67.959	1.761	76.426	2.506	84.875	3.437	350
300	8.500	0.004	17.000	0.032	25.500	0.108	33.998	0.257	42.495	0 502	50.987	0.867	59.471	1.376	67.944	2.054	76.399	2.923	84.830	4.008	300
250	8.500	0.005	17.000	0.039	25.499	0.130	33.997	0.308	42.492	0.602	50.981	1.040	59.459	1.651	67.920	2.464	76.355	3.507	84.755	4.807	250
230	8.500	0.005	17.000	0.042	25.499	0.141	33.997	0.335	42.491	0.654	50.977	1.131	59.451	1.795	67.905	2.678	76.329	3.811	84.710	5.223	230
200	8.500	0.006	17.000	0.048	25.499	0.163	33.996	0.385	42.488	0.752	50.970	1.300	59.436	2.064	67.874	3.079	76.274	4.380	84.617	6.001	200
170	8.500	0.007	17.000	0.057	25.499	0.191	33.995	0.453	42.483	0.885	50.959	1.529	59.411	2.427	67.826	3.620	76.187	5.149	84.470	7.052	170
155	8.500	0.008	17.000	0.062	25.498	0.210	33.993	0.497	42.480	0.971	50.950	1.677	59.393	2.661	67.791	3.969	76.124	5.644	84.363	7.727	155
125	8.500	0.010	17.000	0.077	25.498	0.260	33.990	0.616	42.469	1.204	50.924	2.079	59.335	3.298	67.679	4.916	75.922	6.985	84.023	9.554	125
100	8.500	0.012	17.000	0.096	25.496	0.325	33.984	0.770	42.452	1.504	50.881	2.597	59.242	4.118	67.499	6.133	75.598	8.704	83.477	11.887	100
90	8.500	0.013	16.999	0.107	25.495	0.361	33.981	0.856	42.441	1 671	50.853	2.884	59.182	4.572	67.382	6.806	75.388	9.652	83.124	13.168	90
80	8.500	0.015	16.999	0.120	25.494	0.406	33.975	0.963	42.425	1.879	50.814	3.243	59.098	5.138	67.218	7.643	75.096	10.829	82.632	14.751	80
70	8.500	0.017	16.999	0.138	24.492	0.464	33.968	1.100	42.402	2.147	50.757	3.703	58.976	5.863	66.980	8.713	74.670	12.326	81.920	16.755	70
60	8.500	0.020	16.999	0.161	25.490	0.542	33.956	1.283	42.367	2.503	50.669	4.315	58.787	6.825	66.616	10.126	74.020	14.290	80.833	19.362	60
55	8.500	0.022	16.998	0.175	25.488	0.591	33.948	1.400	42.342	2.729	50.607	4.703	58.653	7.433	66.356	11.015	73.557	15.520	80.063	20.978	55
50	8.500	0.024	16.998	0.193	25.485	0.650	33.937	1.539	42.308	3.001	50.525	5.167	58.476	8.159	66.015	12.072	72.952	16.971	79.061	22.869	50
45	8.500	0.027	16.998	0.214	25.482	0.722	33.922	1.710	42.264	3.332	50.414	5.732	58.238	9.035	65.557	13.347	72.143	18.707	77.725	25.102	45
40	8.500	0.030	16.997	0.241	25.477	0.812	33.902	1.923	42.201	3.744	50.259	6.435	57.907	10.128	64.922	14.912	71.025	20.812	75.893	27.762	40
35	8.500	0.034	16.996	0.275	25.470	0.928	33.872	2.196	42.110	4.272	50.034	7.331	57.428	11.506	64.006	16.870	69.423	23.400	73.293	30.947	35
33	8.500	0.036	16.995	0.292	25.466	0.984	33.856	2.328	42.062	4.528	49.915	7.762	57.174	12.164	63.523	17.796	68.584	24.604	71.943	32.388	33
30	8.500	0.040	16.995	0.321	25.459	1.082	33.826	2.559	41.970	4.973	49.689	8.510	56.696	13.301	62.619	19.376	67.022	26.622	69.453	34.739	30
25																					25
23																					23
20																					20
15																					15
14																					14

Appendix 4

TABLE II : SETOUT TABLE FOR TRANSITION CURVES

R_C	Length of Transition Curve to Chord Points in Metre										L.T.	S.T.	L.C.	Θ_s	s	K	R_C
	9.0	18.0	27.0	36.0	45.0	54.0	63.0	72.0	81.0	90.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 12	0 0 49	0 1 51	0 3 18	0 5 9	0 7 25	0 10 6	0 13 12	0 16 42	0 20 37	60.001	30.001	89.999	1 1 52	0.135	45.000	2500
2200	0 0 14	0 0 56	0 2 6	0 3 45	0 5 51	0 8 26	0 11 29	0 15 0	0 18 59	0 23 26	60.001	30.001	89.998	1 10 19	0.153	44.999	2200
2000	0 0 15	0 1 1	0 2 19	0 4 7	0 6 26	0 9 16	0 12 38	0 16 30	0 20 53	0 25 46	60.002	30.001	89.998	1 17 20	0.169	44.999	2000
1800	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	60.002	30.002	89.998	1 25 56	0.187	44.999	1800
1500	0 0 20	0 1 22	0 3 5	0 5 30	0 8 35	0 12 22	0 16 50	0 22 0	0 27 50	0 34 22	60.003	30.003	89.996	1 43 7	0.225	44.999	1500
1200	0 0 25	0 1 43	0 3 52	0 6 52	0 10 44	0 15 28	0 21 3	0 27 30	0 34 48	0 42 58	60.004	30.004	89.994	2 8 54	0.281	44.998	1200
1000	0 0 30	0 2 3	0 4 38	0 8 15	0 12 53	0 18 33	0 25 16	0 33 0	0 41 46	0 51 33	60.006	30.006	89.992	2 34 41	0.337	44.997	1000
900	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17	60.008	30.007	89.990	2 51 53	0.375	44.996	900
800	0 0 38	0 2 34	0 5 48	0 10 18	0 16 6	0 23 12	0 31 35	0 41 15	0 52 12	1 4 27	60.010	30.009	89.987	3 13 22	0.422	44.995	800
700	0 0 44	0 2 56	0 6 37	0 11 47	0 18 24	0 26 31	0 36 5	0 47 8	0 59 40	1 13 39	60.013	30.012	89.983	3 40 59	0.482	44.994	700
600	0 0 51	0 3 26	0 7 44	0 13 45	0 21 29	0 30 56	0 42 6	0 55 0	1 9 36	1 25 56	60.018	30.016	89.977	4 17 49	0.562	44.992	600
500	0 1 1	0 4 7	0 9 16	0 16 30	0 25 46	0 37 7	0 50 32	1 6 0	1 23 32	1 43 7	60.025	30.023	89.968	5 9 23	0.675	44.988	500
400	0 1 17	0 5 9	0 11 36	0 20 37	0 32 13	0 46 24	1 3 10	1 22 30	1 44 24	2 8 54	60.040	30.036	89.949	6 26 44	0.843	44.981	400
360	0 1 25	0 5 43	0 12 53	0 22 55	0 35 48	0 51 33	1 10 11	1 31 40	1 56 0	2 23 13	60.049	30.045	89.937	7 9 43	0.937	44.976	360
350	0 1 28	0 5 53	0 13 15	0 23 34	0 36 49	0 53 2	1 12 11	1 34 17	1 59 19	2 27 18	60.052	30.047	89.934	7 21 59	0.964	44.975	350
300	0 1 43	0 6 52	0 15 28	0 27 30	0 42 58	1 1 52	1 24 13	1 49 59	2 19 12	2 51 51	60.071	30.064	89.910	8 35 39	1.124	44.966	300
250	0 2 3	0 8 15	0 18 33	0 33 0	0 51 33	1 14 15	1 41 3	2 11 59	2 47 2	3 26 12	60.102	30.093	89.870	10 18 47	1.348	44.951	250
230	0 2 14	0 8 58	0 20 10	0 35 52	0 56 2	1 20 42	1 49 50	2 23 28	3 1 33	3 44 7	60.120	30.110	89.846	11 12 36	1.465	44.942	230
200	0 2 34	0 10 18	0 23 12	0 41 15	1 4 27	1 32 48	2 6 19	2 44 58	3 28 47	4 17 43	60.159	30.145	89.797	12 53 29	1.684	44.923	200
170	0 3 1	0 12 7	0 27 17	0 48 31	1 15 49	1 49 11	2 28 36	3 14 5	4 5 36	5 3 9	60.220	30.202	89.718	15 9 59	1.980	44.893	170
155	0 3 19	0 13 18	0 29 56	0 53 13	1 23 10	1 59 45	2 42 59	3 32 51	4 29 20	5 32 26	60.264	30.243	89.660	16 38 3	2.171	44.871	155
125	0 4 7	0 16 30	0 37 7	1 6 0	1 43 7	2 28 29	3 22 5	4 23 54	5 33 54	6 52 4	60.405	30.375	89.476	20 37 35	2.688	44.799	125
100	0 5 9	0 20 37	0 46 24	1 22 30	2 8 54	3 5 35	4 12 34	5 29 47	6 57 12	8 34 46	60.632	30.591	89.176	25 46 59	3.351	44.681	100
90	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	60.779	30.733	88.978	28 38 52	3.717	44.602	90
80	0 6 26	0 25 46	0 58 0	1 43 7	2 41 7	3 51 58	5 15 38	6 52 4	8 41 11	10 42 50	60.984	30.934	88.700	32 13 44	4.171	44.488	80
70	0 7 21	0 29 27	1 6 17	1 57 51	3 4 7	4 25 4	6 0 39	7 50 47	9 55 18	12 14 3	60.982	31.233	88.289	36 49 58	4.751	44.317	70
60	0 8 35	0 34 22	1 17 20	2 17 29	3 34 47	5 9 12	7 0 38	9 8 57	11 33 56	14 15 17	61.739	31.706	87.644	42 58 18	5 513	44.039	60
55	0 9 22	0 37 30	1 24 22	2 29 59	3 54 18	5 37 16	7 38 46	9 58 38	12 36 34	15 32 10	62.065	32.054	87.174	46 52 42	5.992	43.830	55
50	0 10 18	0 41 15	1 32 48	2 44 58	4 17 43	6 10 56	8 24 30	10 58 10	13 51 33	17 4 6	62.492	32.525	86.545	51 33 58	6.558	43.544	50
45	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58	63.070	33.185	85.678	57 17 44	7.238	43.134	45
40	0 12 53	0 51 33	1 56 0	3 26 12	5 22 4	7 43 26	10 30 2	13 41 23	17 16 43	21 14 54	63.882	34 157	84.435	64 27 28	8.066	42.519	40
35	0 14 43	0 58 55	2 12 35	3 55 38	6 8 0	8 49 25	11 59 28	15 37 25	19 42 8	24 11 51	65.085	35.690	82.562	73 39 57	9.093	41.535	35
33	0 15 37	1 2 30	2 20 37	4 9 55	6 30 16	9 21 23	12 42 45	16 33 30	20 52 14	25 36 52	65.743	36.568	81.537	78 7 50	9.574	40.970	33
30	0 17 11	1 8 45	2 34 40	4 34 53	7 9 12	10 17 15	13 58 20	18 11 18	22 54 15	28 4 18	67.036	38.361	79.557	85 56 37	10.387	39.825	30
25																	25
23																	23
20																	20
15																	15
14																	14

L_s = 90 metre

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

L_s = 90 metre

R_C	Length of Transition Curve to Chord Points in Metre																				R_C
	9.0		8.0		27.0		36.0		45.0		54.0		63.0		72.0		81.0		90.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7.	Y. 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	9.000	0.001	18.000	0.004	27.000	0.015	36.000	0.035	45.000	0.067	54.000	0.117	63.000	0.185	71.999	0.276	80.998	0.394	89.997	0.540	**2500**
2200	9.000	0.001	18.000	0.005	27.000	0.017	36.000	0.039	45.000	0.077	54.000	0.133	62.999	0.210	71.999	0.314	80.998	0.447	89.996	0.614	**2200**
2000	9.000	0.001	18.000	0.005	27.000	0.018	36.000	0.043	45.000	0.084	54.000	0.146	62.999	0.232	71.999	0.346	80.997	0.492	89.995	0.675	**2000**
1800	9.000	0.001	18.000	0.006	27.000	0.020	36.000	0.048	45.000	0.094	54.000	0.162	62.999	0.257	71.998	0.384	80.097	0.547	89.994	0.750	**1800**
1500	9.000	0.001	18.000	0.007	27.000	0.024	36.000	0.058	45.000	0.112	53.999	0.194	62.999	0.309	71.997	0.461	80.995	0.656	89.992	0.900	**1500**
1200	9.000	0.001	18.000	0.009	27.000	0.030	36.000	0.072	45.000	0.141	53.999	0.243	62.998	0.386	71.996	0.576	80.993	0.820	89.987	1.125	**1200**
1000	9.000	0.001	18.000	0.011	27.000	0.036	36.000	0.086	44.999	0.169	53.999	0.292	62.997	0.463	71.994	0.691	80.989	0.984	89.982	1.350	**1000**
900	9.000	0.002	18.000	0 012	27.000	0.040	36.000	0.096	44.999	0.187	53.998	0.324	62.996	0.514	71.993	0.768	80.987	1.093	89.978	1.500	**900**
800	9.000	0.002	18.000	0 013	27.000	0.046	36.000	0.108	44.999	0.211	53.998	0.364	62.995	0.579	71.991	0.864	80.983	1.230	89.972	1.687	**800**
700	9.000	0.002	18.000	0.015	27.000	0.052	36.000	0.123	44.999	0.241	53.997	0.417	62.994	0.661	71.988	0.987	80 978	1.406	89.963	1.928	**700**
600	9.000	0.002	18.000	0.018	27.000	0.061	35.999	0.144	44.998	0.281	53.996	0.486	62.991	0 772	71.983	1.152	80.970	1.640	89.949	2.249	**600**
500	9.000	0.003	18.000	0.022	27.000	0.073	35.999	0.173	44.998	0.337	53.994	0.583	62 988	0.926	71.976	1.382	80.957	1 968	89.927	2.698	**500**
400	9.000	0.003	18.000	0.027	27.000	0.091	35.999	0.216	44.996	0.422	53.991	0.729	62.981	1.157	71.963	1.727	80.933	2.459	89.886	3.372	**400**
360	9.000	0 004	18.000	0.030	27.000	0.101	35.999	0.240	44.996	0.469	53.989	0.810	62.976	1.286	71.954	1.919	80.917	2.732	89.859	3.746	**360**
350	9.000	0.004	18.000	0.031	27.000	0.104	35.998	0.247	44.995	0.482	53.988	0.833	62.975	1.323	71.951	1.974	80.912	2.810	89.851	3.853	**350**
300	9.000	0.005	18.000	0.036	27.000	0.121	35.998	0.288	44.994	0.562	53.984	0.972	62.966	1.543	71.934	2.302	80.881	3.277	89.798	4.493	**300**
250	9.000	0.005	18.000	0.043	26.999	0.146	35.997	0.346	44.991	0.675	53.977	1.166	62.951	1.851	71.905	2.762	80.828	3.931	89.709	5.388	**250**
230	9.000	0.006	18.000	0.047	26.999	0.158	35.996	0.376	44 989	0.734	53.973	1 267	62.942	2.012	71.887	3 002	80.797	4.271	89.656	5.854	**230**
200	9.000	0.007	18.000	0.054	26.999	0.182	35.995	0 432	44.986	0 844	53.965	1.457	62.923	2.313	71.851	3.451	80.731	4.909	89.545	6.726	**200**
170	9.000	0.008	18.000	0.064	26 998	0.214	35.994	0.508	44.980	0 992	53.951	1.714	62.894	2.721	71.794	4.058	80.628	5.770	89.371	7.902	**170**
155	9.000	0.009	18.000	0.070	26.998	0 235	35.992	0.557	44.976	1.088	53.941	1.880	62.873	2.983	71.752	4.448	80.553	6 324	89.244	8.657	**155**
125	9.000	0.011	18.000	0.086	26.997	0.292	35.988	0.691	44.964	1.349	53.909	2.330	62.804	3.696	71.619	5.509	80.314	7.826	88.841	10 700	**125**
100	9.000	0.013	17.999	0.108	26.996	0.364	35.981	0 864	44.943	1.686	53.858	2.911	62.694	4.614	71.405	6.871	79.930	9.748	88 195	13.306	**100**
90	9.000	0.015	17.999	0.120	26.995	0.405	35.977	0.960	44 930	1.873	53.825	3.233	62.623	5.123	71.266	7.624	79.681	10.808	87.776	14.734	**90**
80	9.000	0.017	17.999	0.135	26.993	0.456	35.971	1.079	44.911	2.106	53.779	3.634	62.523	5.757	71.072	8.560	79.335	12.121	87.194	16.497	**80**
70	9.000	0.019	17.999	0.154	26.991	0 521	35.962	1.233	44.884	2.406	53.712	4.150	62.378	6.568	70.791	9.756	78.831	13.789	86.351	18.724	**70**
60	9.000	0.022	17.998	0.180	26.988	0.607	35.948	1 439	44.842	2.805	53.608	4.835	62.154	7.643	70.359	11.332	78.061	15.975	85.068	21.612	**60**
55	9.000	0.025	17.998	0.196	26.985	0.662	35 938	1.569	44.812	3.059	53.533	5.269	61.995	8.323	70.051	12.323	77.514	17.340	84.159	23.396	**55**
50	9.000	0 027	17.998	0.216	26.982	0.729	35.925	1.725	44 773	3.363	53.436	5.788	61 786	9 133	69 648	13.500	76.800	18 948	82.978	25.478	**50**
45	9.000	0.030	17.997	0.240	26.978	0.810	35.908	1.916	44.720	3.733	53.304	6 420	61.504	10.115	69.106	14.916	75.845	20.866	81.407	27.924	**45**
40	9.000	0.034	17.996	0.270	26 972	0.911	35.884	2.155	44.645	4.195	53.121	7.205	61.112	11.327	68.356	16.651	74.528	23.182	79.257	30.819	**40**
35	9.000	0.039	17.995	0.309	26.964	1.040	35.848	2.461	44.537	4.786	52.855	8.205	60.545	12.860	67.275	18.814	72.645	26 014	76.218	34.250	**35**
33	9.000	0.041	17.995	0.327	26.959	1.103	35.829	2.609	44.480	5.071	52.713	8.685	60.245	13.591	66.706	19 833	71.660	27.323	74.643	35.787	**33**
30	9.000	0.045	17.994	0.360	26.951	1.213	35.793	2.868	44.371	5.569	52.446	9.519	59.681	14.850	65.642	21.567	69.832	29.504	71.750	38.265	**30**
25																					**25**
23																					**23**
20																					**20**
15																					**15**
14																					**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_C	Length of Transition Curve to Chord Points in Metre										L.T.	S.T.	L.C.	Θ_s	s	Ls=95 metre K	R_C
	9.5	19.0	28.5	38.0	47.5	57.0	66.5	76.0	85.5	95.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 13	0 0 52	0 1 57	0 3 29	0 5 26	0 7 50	0 10 40	0 13 56	0 17 38	0 21 46	63.335	31.668	94.998	1 5 19	0.150	47.499	**2500**
2200	0 0 14	0 0 59	0 2 13	0 3 57	0 6 11	0 8 54	0 12 7	0 15 50	0 20 2	0 24 44	63.335	31.668	94.998	1 14 13	0.171	47.499	**2200**
2000	0 0 16	0 1 5	0 2 26	0 4 21	0 6 48	0 9 47	0 13 20	0 17 25	0 22 2	0 27 12	63.335	31.668	94.998	1 21 38	0.188	47.499	**2000**
1800	0 0 18	0 1 12	0 2 43	0 4 50	0 7 33	0 10 53	0 14 49	0 19 21	0 24 29	0 30 14	63.336	31.669	94.997	1 30 43	0.209	47.499	**1800**
1500	0 0 21	0 1 27	0 3 15	0 5 48	0 9 4	0 13 3	0 17 46	0 23 13	0 29 23	0 36 17	63.337	31.670	94.996	1 48 51	0.251	47.498	**1500**
1200	0 0 27	0 1 48	0 4 4	0 7 15	0 11 20	0 16 19	0 22 13	0 29 1	0 36 44	0 45 21	63.339	31.671	94.993	2 16 4	0 313	47.498	**1200**
1000	0 0 32	0 2 10	0 4 53	0 8 42	0 13 36	0 19 35	0 26 40	0 34 50	0 44 5	0 54 25	63.341	31.673	94.990	2 43 17	0.376	47.496	**1000**
900	0 0 36	0 2 25	0 5 26	0 9 40	0 15 7	0 21 46	0 29 38	0 38 42	0 48 59	1 0 28	63.343	31.675	94.988	3 1 26	0.418	47.496	**900**
800	0 0 40	0 2 43	0 6 7	0 10 53	0 17 0	0 24 29	0 33 20	0 43 32	0 55 6	1 8 2	63.345	31.677	94.985	3 24 6	0.470	47.494	**800**
700	0 0 46	0 3 6	0 6 59	0 12 26	0 19 26	0 27 59	0 38 6	0 49 45	1 2 58	1 17 45	63.349	31.681	94.981	3 53 16	0.537	47.493	**700**
600	0 0 54	0 3 37	0 8 9	0 14 30	0 22 40	0 32 39	0 44 27	0 58 3	1 13 28	1 30 42	63.354	31.686	94.974	4 32 9	0.627	47.490	**600**
500	0 1 5	0 4 21	0 9 47	0 17 25	0 27 12	0 39 11	0 53 20	1 9 40	1 28 10	1 48 51	63.363	31.694	94.962	5 26 35	0.752	47.486	**500**
400	0 1 21	0 5 26	0 12 14	0 21 46	0 34 1	0 48 59	1 6 40	1 27 5	1 50 12	2 16 3	63.380	31.709	94.940	6 48 13	0.940	47.478	**400**
360	0 1 30	0 6 2	0 13 36	0 24 11	0 37 47	0 54 25	1 14 5	1 36 45	2 2 27	2 31 10	63.391	31.719	94.926	7 33 35	1.044	47.472	**360**
350	0 1 33	0 6 13	0 13 59	0 24 52	0 38 52	0 55 59	1 16 12	1 39 31	2 5 57	2 35 29	63.394	31.722	94.922	7 46 33	1.074	47.471	**350**
300	0 1 48	0 7 15	0 16 19	0 29 1	0 45 21	1 5 18	1 28 53	1 56 6	2 26 56	3 1 23	63.416	31.742	94.894	9 4 18	1.252	47.460	**300**
250	0 2 10	0 8 42	0 19 35	0 34 50	0 54 25	1 18 22	1 46 40	2 19 19	2 56 19	3 37 39	63.453	31.776	94.847	10 53 10	1.502	47.442	**250**
230	0 2 21	0 9 27	0 21 17	0 37 51	0 59 9	1 25 11	1 55 57	2 31 26	3 11 38	3 56 34	63.475	31.796	94.819	11 49 58	1.632	47.432	**230**
200	0 2 43	0 10 53	0 24 29	0 43 32	1 8 2	1 37 58	2 13 20	2 54 8	3 40 22	4 32 1	63.520	31.838	94.761	13 36 27	1.876	47.409	**200**
170	0 3 12	0 12 48	0 28 48	0 51 13	1 20 2	1 55 15	2 36 51	3 24 51	4 19 14	5 19 58	63.592	31.904	94.668	16 0 32	2.206	47.374	**170**
155	0 3 30	0 14 2	0 31 36	0 56 11	1 27 47	2 6 24	2 52 2	3 44 40	4 44 17	5 50 53	63.644	31.953	94.600	17 33 30	2.418	47.348	**155**
125	0 4 21	0 17 25	0 39 11	1 9 40	1 48 51	2 36 44	3 33 18	4 38 32	5 52 25	7 14 54	63 810	32.109	94.383	21 46 20	2.993	47.263	**125**
100	0 5 26	0 21 46	0 48 59	1 27 5	2 16 3	3 15 54	4 26 35	5 48 5	7 20 20	9 3 15	64 076	32 363	94.029	27 12 55	3.730	47.123	**100**
90	0 6 2	0 24 11	0 54 25	1 36 45	2 31 10	3 37 39	4 56 10	6 26 41	8 9 7	10 3 21	64.249	32.532	93.796	30 14 22	4.137	47.028	**90**
80	0 6 48	0 27 12	1 1 14	1 48 51	2 50 3	4 4 50	5 33 9	7 14 54	9 10 1	11 18 20	64.490	32.770	93.467	34 1 9	4.642	46.893	**80**
70	0 7 46	0 31 6	1 1 58	2 4 24	3 14 20	4 39 47	6 20 39	8 16 51	10 28 13	12 54 31	64.839	33.124	92.980	38 52 45	5 285	46.688	**70**
60	0 9 4	0 36 17	1 2 38	2 25 7	3 46 43	5 26 21	7 23 57	9 39 19	12 12 14	15 2 17	65.375	33.687	92.216	45 21 33	6.129	46.354	**60**
55	0 9 53	0 39 35	1 2 9 3	2 38 19	4 7 18	5 55 59	8 4 11	10 31 43	13 18 15	16 23 17	65 758	34.103	91.657	49 28 57	6.658	46.103	**55**
50	0 10 53	0 43 32	1 3 7 58	2 54 8	4 32 1	6 31 30	8 52 26	11 34 31	14 37 17	18 0 7	66.261	34.667	90.910	54 25 51	7.283	45.755	**50**
45	0 12 5	0 48 22	1 48 51	3 13 29	5 2 12	7 14 54	9 51 20	12 51 6	16 13 35	19 57 51	66.941	35.462	89.878	60 28 44	8 032	45.257	**45**
40	0 13 36	0 54 25	2 2 27	3 37 39	5 39 56	8 9 7	11 4 51	14 26 34	18 13 23	22 23 57	67.901	36.641	88.396	68 2 19	8.941	44.506	**40**
35	0 15 33	1 2 12	2 19 56	4 8 43	6 28 24	9 18 43	12 39 9	16 28 50	20 46 25	25 29 48	69.335	38.519	86.161	77 45 30	10.064	43.298	**35**
33	0 16 29	1 5 58	2 28 25	4 23 47	6 51 54	9 52 26	13 24 46	17 27 53	22 0 8	26 59 0	70.128	39.605	84.937	82 28 16	10.588	42.602	**33**
30																	**30**
25																	**25**
23																	**23**
20																	**20**
15																	**15**
14																	**14**

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 95 metre

R_c	Length of Transition Curve to Chord Points in Metre										R_c
	9.5	19.0	28.5	38.0	47.5	57.0	66.5	76.0	85.5	95.0	
metre	X1 Y1	X2 Y2	X3 Y3	X4 Y4	X5 Y5	X6 Y6	X7 Y7	X8 Y8	X9 Y9	X10 Y10	metre
2500	9.500 0.001	19.000 0.005	28.500 0.016	38.000 0.039	47.500 0.075	57.000 0.130	66.499 0.206	75.999 0.308	85.498 0.439	94.997 0.602	2500
2200	9.500 0.001	19.000 0.005	28.500 0.018	38.000 0.044	47.500 0.085	57.000 0.148	66.499 0.235	75.999 0.350	85.497 0.498	94.996 0.684	2200
2000	9.500 0.001	19.000 0.006	28.500 0.020	38.000 0.048	47.500 0.094	57.000 0.162	66.499 0.258	75.998 0.385	85.497 0.548	94.995 0.752	2000
1800	9.500 0.001	19.000 0.007	28.500 0.023	38.000 0.053	47.500 0.104	56.999 0.180	66.499 0.287	75.998 0.428	85.496 0.609	94.993 0.836	1800
1500	9.500 0.001	19.000 0.008	28.500 0.027	38.000 0.064	47.500 0.125	56.999 0.217	66.498 0.344	75.997 0.513	85.494 0.731	94.990 1.003	1500
1200	9.500 0.001	19.000 0.010	28.500 0.034	38.000 0.080	47.500 0.157	56.999 0.271	66.497 0.430	75.995 0.642	85.491 0.914	94.985 1.253	1200
1000	9.500 0.002	19.000 0.012	28.500 0.041	38.000 0.096	47.499 0.188	56.998 0.325	66.496 0.516	75.993 0.770	85.487 1.096	94.979 1.504	1000
900	9.500 0.002	19.000 0.013	28.500 0.045	38.000 0.107	47.499 0.209	56.998 0.361	66.496 0.573	75.991 0.856	85.484 1.218	94.974 1.671	900
800	9.500 0.002	19.000 0.015	28.500 0.051	38.000 0.120	47.499 0.235	56.997 0.406	66.494 0.645	75.989 0.963	85.480 1.370	94.967 1.880	800
700	9.500 0.002	19.000 0.017	28.500 0.058	38.000 0.138	47.499 0.269	56.997 0.464	66.493 0.737	75.986 1.100	85.474 1.566	94.956 2.148	700
600	9.500 0.003	19.000 0.020	28.500 0.068	37.999 0.160	47.498 0.313	56.995 0.541	66.490 0.860	75.980 1.283	85.465 1.827	94.940 2.506	600
500	9.500 0.003	19.000 0.024	28.500 0.081	37.999 0.193	47.497 0.376	56.993 0.650	66.486 1.032	75.972 1.540	85.449 2.192	94.914 3.006	500
400	9.500 0.004	19.000 0.030	28.500 0.102	37.999 0.241	47.496 0.470	56.990 0.812	66.477 1.290	75.956 1.925	85.421 2.740	94.866 3.757	400
360	9.500 0.004	19.000 0.033	28.500 0.113	37.998 0.267	47.495 0.522	56.987 0.902	66.472 1.433	75.946 2.138	85.402 3.043	94.835 4.173	360
350	9.500 0.004	19.000 0.034	28.500 0.116	37.998 0.275	47.495 0.537	56.986 0.928	66.471 1.474	75.943 2.199	85.397 3.130	94.825 4.292	350
300	9.500 0.005	19.000 0.040	28.499 0.135	37.998 0.321	47.493 0.627	56.981 1.083	66.460 1.719	75.922 2.565	85.359 3.651	94.762 5.005	300
250	9.500 0.006	19.000 0.048	28.499 0.162	37.996 0.385	47.489 0.752	56.973 1.299	66.442 2.062	75.888 3.077	85.298 4.379	94.658 6.001	250
230	9.500 0.007	19.000 0.052	28.499 0.177	37.996 0.419	47.487 0.817	56.969 1.412	66.432 2.242	75.867 3.344	85.261 4.758	94.596 6.520	230
200	9.500 0.008	19.000 0.060	28.499 0.203	37.995 0.481	47.483 0.940	56.958 1.624	66.410 2.577	75.825 3.844	85.184 5.468	94.466 7.491	200
170	9.500 0.009	19.000 0.071	28.498 0.239	37.992 0.566	47.477 1.106	56.942 1.910	66.375 3.031	75.757 4.520	85.063 6.427	94.261 8.799	170
155	9.500 0.010	19.000 0.078	28.498 0.262	37.991 0.621	47.472 1.213	56.931 2.094	66.350 3.323	75.708 4.955	84.975 7.043	94.112 9.639	155
125	9.500 0.012	19.000 0.096	28.497 0.325	37.986 0.770	47.457 1.503	56.893 2.596	66.270 4.117	75.552 6.135	84.694 8.713	93.637 11.910	125
100	9.500 0.015	18.999 0.120	28.495 0.406	37.978 0.962	47.433 1.878	56.834 3.242	66.141 5.139	75.301 7.651	84.243 10.850	92.879 14.801	100
90	9.500 0.017	18.999 0.134	28.494 0.451	37.973 1.069	47.417 2.087	56.795 3.601	66.057 5.705	75.137 8.488	83.951 12.026	92.388 16.383	90
80	9.500 0.019	18.999 0.150	28.492 0.508	37.966 1.203	47.395 2.347	56.740 4.048	65.939 6.410	74.910 9.528	83.543 13.482	91.705 18.334	80
70	9.500 0.021	18.999 0.172	28.489 0.580	37.955 1.374	47.363 2.680	56.661 4.622	65.769 7.312	74.579 10.855	82.953 15.330	90.718 20.792	70
60	9.500 0.025	18.998 0.201	28.486 0.677	37.939 1.603	47.314 3.125	56.539 5.384	65.506 8.507	74.072 12.602	82.051 17.746	89.216 23.969	60
55	9.500 0.027	18.998 0.219	28.483 0.738	37.928 1.748	47.279 3.407	56.451 5.867	65.319 9.261	73.711 13.700	81.410 19.251	88.155 25.926	55
50	9.500 0.030	18.997 0.241	28.479 0.812	37.912 1.922	47.233 3.745	56.337 6.444	65.073 10.160	73.238 15.001	80.574 21.020	86.777 28.199	50
45	9.500 0.033	18.997 0.267	28.474 0.902	37.892 2.135	47.170 4.158	56.182 7.146	64.743 11.248	72.604 16.564	79.458 23.124	84.947 30.858	45
40	9.500 0.038	18.996 0.301	28.467 1.014	37.863 2.400	47.083 4.671	55.967 8.017	64.283 12.590	71.726 18.473	77.921 25.654	82.450 33.982	40
35	9.500 0.043	18.994 0.344	28.458 1.159	37.821 2.741	46.956 5.328	55.654 9.126	63.619 14.282	70.463 20.846	75.730 28.727	78.931 37.643	35
33	9.500 0.046	18.994 0.365	28.452 1.229	37.799 2.906	46.889 5.645	55.488 9.658	63.267 15.087	69.799 21.960	74.586 30.138	77.115 39.264	33
30											30
25											25
23											23
20											20
15											15
14											14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=100 metre

R_C	Length of Transition Curve to Chord Points in Metre										L. T.	S. T	L. C.	Θ_s	s	K	R_C
	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 13	0 0 55	0 2 3	0 3 40	0 5 43	0 8 15	0 11 13	0 14 40	0 18 33	0 22 55	66.668	33.335	99.998	1 8 45	0.167	49.999	**2500**
2200	0 0 15	0 1 2	0 2 20	0 4 10	0 6 30	0 9 22	0 12 45	0 16 40	0 21 5	0 26 2	66.668	33.335	99.998	1 18 7	0.189	49.999	**2200**
2000	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	66.669	33.335	99.997	1 25 56	0.208	49.999	**2000**
1800	0 0 19	0 1 16	0 2 51	0 5 5	0 7 57	0 11 27	0 15 35	0 20 22	0 25 46	0 31 49	66.669	33.336	99.997	1 35 29	0.231	49.999	**1800**
1500	0 0 22	0 1 31	0 3 26	0 6 6	0 9 32	0 13 45	0 18 42	0 24 26	0 30 56	0 38 11	66.671	33.337	99.995	1 54 35	0.278	49.998	**1500**
1200	0 0 28	0 1 54	0 4 17	0 7 38	0 11 56	0 17 11	0 23 23	0 30 33	0 38 40	0 47 44	66.673	33.339	99.992	2 23 14	0.347	49.997	**1200**
1000	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17	66.675	33.341	99.989	2 51 53	0.417	49.996	**1000**
900	0 0 38	0 2 32	0 5 43	0 10 11	0 15 54	0 22 55	0 31 11	0 40 44	0 51 33	1 3 39	66.677	33.343	99.986	3 10 59	0.463	49.995	**900**
800	0 0 42	0 2 51	0 6 26	0 11 27	0 17 54	0 25 46	0 35 5	0 45 50	0 58 0	1 11 37	66.680	33.346	99.983	3 34 51	0.521	49.993	**800**
700	0 0 49	0 3 16	0 7 21	0 13 5	0 20 27	0 29 27	0 40 6	0 52 23	1 6 17	1 21 50	66.684	33.350	99.977	4 5 33	0.595	49.991	**700**
600	0 0 57	0 3 49	0 8 35	0 15 16	0 23 52	0 34 22	0 46 47	1 1 6	1 17 20	1 35 29	66.691	33.355	99.969	4 46 28	0.694	49.988	**600**
500	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34	66.702	33.365	99.956	5 43 46	0.833	49.983	**500**
400	0 1 25	0 5 43	0 12 53	0 22 55	0 35 48	0 51 33	1 10 11	1 31 40	1 56 0	2 23 13	66.721	33.383	99.930	7 9 43	1 041	49.974	**400**
360	0 1 35	0 6 21	0 14 19	0 25 27	0 39 47	0 57 17	1 17 58	1 41 51	2 8 54	2 39 7	66.734	33.395	99.914	7 57 27	1.157	49.968	**360**
350	0 1 38	0 6 32	0 14 43	0 26 11	0 40 55	0 58 55	1 20 12	1 44 45	2 12 35	2 43 40	66.738	33.398	99.909	8 11 6	1.190	49.966	**350**
300	0 1 54	0 7 38	0 17 11	0 30 33	0 47 44	1 8 45	1 33 34	2 2 13	2 34 40	3 10 56	66.764	33.422	99.876	9 32 57	1.388	49.953	**300**
250	0 2 17	0 9 10	0 20 37	0 36 40	0 57 17	1 22 30	1 52 17	2 26 39	3 5 35	3 49 6	66 806	33.461	99.822	11 27 32	1.664	49.933	**250**
230	0 2 29	0 9 57	0 22 25	0 39 51	1 2 16	1 29 40	2 2 3	2 39 24	3 21 43	4 9 0	66.831	33.484	99.789	12 27 20	1.809	49.920	**230**
200	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	66.884	33.533	99.721	14 19 26	2.079	49.894	**200**
170	0 3 22	0 13 28	0 30 19	0 53 55	1 24 15	2 1 19	2 45 7	3 35 38	4 32 51	5 36 47	66.968	33.610	99.613	16 51 6	2.443	49.853	**170**
155	0 3 41	0 14 47	0 33 16	0 59 8	1 32 24	2 13 3	3 1 5	3 56 29	4 59 14	6 9 19	67.029	33.667	99.533	18 28 57	2.678	49.822	**155**
125	0 4 35	0 18 20	0 41 15	1 13 20	1 54 34	2 44 58	3 44 31	4 53 11	6 10 56	7 37 44	67.222	33.850	99.279	22 55 6	3.314	49.723	**125**
100	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	67.532	34.148	98.865	28 38 52	4.130	49.557	**100**
90	0 6 21	0 25 27	0 57 17	1 41 51	2 39 7	3 49 6	5 11 44	6 46 59	8 34 46	10 34 56	67.734	34.345	98.592	31 49 51	4.579	49.446	**90**
80	0 7 9	0 28 38	1 4 27	1 54 34	2 59 0	4 17 43	5 50 39	7 37 44	9 38 51	11 53 48	68.014	34.625	98.206	35 48 35	5.136	49.286	**80**
70	0 8 11	0 32 44	1 13 39	2 10 56	3 24 34	4 54 29	6 40 39	8 42 54	11 1 6	13 34 55	68.421	35.043	97.635	40 55 32	5.845	49.042	**70**
60	0 9 32	0 38 11	1 25 56	2 32 45	3 58 38	5 43 30	7 47 15	10 9 40	12 50 28	15 49 13	69.045	35.708	96.736	47 44 47	6.775	48.645	**60**
55	0 10 25	0 41 40	1 33 45	2 46 38	4 20 19	6 14 41	8 29 35	11 4 47	13 59 53	17 14 18	69.491	36.201	96.079	52 5 13	7.356	48.344	**55**
50	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58	70.078	36.872	95.198	57 17 44	8.042	47.926	**50**
45	0 12 43	0 50 55	1 54 34	3 23 39	5 18 6	7 37 44	10 22 18	13 31 20	17 4 6	20 59 31	70.874	37.823	93.980	63 39 43	8.861	47.326	**45**
40	0 14 19	0 57 17	2 8 54	3 49 6	5 57 48	8 34 46	11 39 37	15 11 41	19 9 55	23 32 42	72.001	39.243	92.228	71 37 11	9.854	46.416	**40**
35	0 16 22	1 5 28	2 27 18	4 21 48	6 48 48	9 48 0	13 18 46	17 20 7	21 50 27	26 47 18	73.705	41.532	89.583	81 51 4	11.073	44.945	**35**
33	0 17 21	1 9 26	2 36 14	4 37 39	7 13 31	10 23 27	14 6 43	18 22 8	23 7 44	28 20 34	74.659	42.870	88.135	86 48 42	11.639	44.094	**33**
30																	**30**
25																	**25**
23																	**23**
20																	**20**
15																	**15**
14																	**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

$L = 100$ metre

R_C	Length of Transition Curve to Chord Points in Metre																				R_C
	10.0		20.0		30.0		40.0		50.0		60.0		70.0		80.0		90.0		100.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	10.000	0.001	20.000	0.005	30.000	0.018	40.000	0.043	50.000	0.083	60.000	0.144	69.999	0.229	79.999	0.341	89.998	0.486	99.996	0.667	**2500**
2200	10.000	0.001	20.000	0.006	30.000	0.020	40.000	0.048	50.000	0.095	60.000	0.164	69.999	0.260	79.998	0.388	89.997	0.552	99.995	0.758	**2200**
2000	10.000	0.001	20.000	0.007	30.000	0.022	40.000	0.053	50.000	0.104	60.000	0.180	69.999	0.286	79.998	0.427	89.996	0.607	99.994	0.833	**2000**
1800	10.000	0.001	20.000	0.007	30.000	0.025	40.000	0.059	50.000	0.116	59.999	0.200	69.999	0.318	79.997	0.474	89.995	0.675	99.992	0.926	**1800**
1500	10.000	0.001	20.000	0.009	30.000	0.030	40.000	0.071	50.000	0.139	59.999	0.240	69.998	0.381	79.996	0.569	89.993	0.810	99.989	1.111	**1500**
1200	10.000	0.001	20.000	0.011	30.000	0.037	40.000	0.089	49.999	0.174	59.999	0.300	69.997	0.476	79.994	0.711	89.990	1.012	99.983	1.389	**1200**
1000	10.000	0.002	20.000	0.013	30.000	0.045	40.000	0.107	49.999	0.208	59.998	0.360	69.996	0.572	79.992	0.853	89.985	1.215	99.975	1.666	**1000**
900	10.000	0.002	20.000	0.015	30.000	0.050	40.000	0.119	49.999	0.231	59.998	0.400	69.995	0.635	79.990	0.948	89.982	1.350	99.969	1.851	**900**
800	10.000	0.002	20.000	0.017	30.000	0.056	40.000	0.133	49.999	0.260	59.997	0.450	69.993	0.715	79.987	1.067	89.977	1.518	99.961	2.083	**800**
700	10.000	0.002	20.000	0.019	30.000	0.064	39.999	0.152	49.998	0.298	59.996	0.514	69.991	0.817	79.983	1.219	89.970	1.735	99.949	2.380	**700**
600	10.000	0.003	20.000	0.022	30.000	0.075	39.999	0.178	49.998	0.347	59.995	0.600	69.988	0.953	79.977	1.422	89.959	2.024	99.931	2.776	**600**
500	10.000	0.003	20.000	0.027	30.000	0.090	39.999	0.213	49.997	0.417	59.992	0.720	69.983	1.143	79.967	1.706	89.941	2.429	99.900	3.331	**500**
400	10.000	0.004	20.000	0.033	30.000	0.112	39.998	0.267	49.995	0.521	59.988	0.900	69.974	1.429	79.949	2.132	89.908	3.035	99.844	4.162	**400**
360	10.000	0.005	20.000	0.037	30.000	0.125	39.998	0.296	49.994	0.579	59.985	1.000	69.968	1.587	79.937	2.369	89.886	3.372	99.807	4.623	**360**
350	10.000	0.005	20.000	0.038	30.000	0.129	39.998	0.305	49.994	0.595	59.984	1.028	69.966	1.633	79.933	2.437	89.880	3.468	99.796	4.755	**350**
300	10.000	0.006	20.900	0.044	29.999	0.150	39.997	0.356	49.991	0.694	59.978	1.200	69.953	1.905	79.909	2.842	89.836	4.045	99.723	5.545	**300**
250	10.000	0.007	20.000	0.053	29.999	0.180	39.996	0.427	49.988	0.833	59.969	1.439	69.933	2.285	79.869	3.409	89.764	4.851	99.601	6.648	**250**
230	10.000	0.007	20.000	0.058	29.999	0.196	39.995	0.464	49.985	0.906	59.963	1.565	69.921	2.483	79.845	3.705	89.721	5.271	99.528	7.222	**230**
200	10.000	0.008	20.000	0.067	29.998	0.225	39.994	0.533	49.980	1.041	59.951	1.799	69.895	2.855	79.795	4.259	89.632	6.057	99.377	8.296	**200**
170	10.000	0.010	20.000	0.078	29.998	0.265	39.991	0.627	49.973	1.225	59.933	2.116	69.855	3.358	79.717	5.007	89.491	7.118	99.138	9.744	**170**
155	10.000	0.011	20.000	0.086	29.997	0.290	39.989	0.688	49.967	1.343	59.919	2.320	69.825	3.682	79.660	5.489	89.387	7.801	98.964	10.673	**155**
125	10.000	0.013	19.999	0.107	29.996	0.360	39.984	0.853	49.950	1.665	59.876	2.876	69.732	4.561	79.477	6.795	89.060	9.647	98.412	13.182	**125**
100	10.000	0.017	19.999	0.133	29.994	0.450	39.974	1.066	49.922	2.081	59.806	3.592	69.581	5.692	79.185	8.471	88.535	12.008	97.529	16.371	**100**
90	10.000	0.019	19.999	0.148	29.993	0.500	39.968	1.185	49.904	2.312	59.760	3.989	69.483	6.318	78.995	9.396	88.195	13.306	96.957	18.114	**90**
80	10.000	0.021	19.999	0.167	29.991	0.562	39.960	1.332	49.878	2.600	59.697	4.484	69.346	7.098	78.729	10.545	87.721	14.912	96.164	20.259	**80**
70	10.000	0.024	19.998	0.190	29.988	0.643	39.948	1.522	49.841	2.969	59.604	5.119	69.147	8.095	78.344	12.010	87.034	16.947	95.017	22.956	**70**
60	10.000	0.028	19.998	0.222	29.983	0.750	39.929	1.776	49.783	3.461	59.462	5.962	68.842	9.415	77.754	13.936	85.985	19.600	93.275	26.430	**60**
55	10.000	0.030	19.997	0.242	29.980	0.818	39.915	1.936	49.742	3.774	59.361	6.496	68.624	10.248	77.334	15.144	85.241	21.250	92.046	28.561	**55**
50	10.000	0.033	19.997	0.267	29.976	0.899	39.898	2.129	49.688	4.148	59.227	7.134	68.338	11.239	76.785	16.574	84.272	23.185	90.452	31.027	**50**
45	10.000	0.037	19.996	0.296	29.970	0.999	39.874	2.365	49.616	4.604	59.047	7.909	67.953	12.437	76.048	18.289	82.978	25.478	88.340	33.897	**45**
40	10.000	0.042	19.995	0.333	29.962	1.124	39.840	2.659	49.514	5.172	58.796	8.871	67.419	13.913	75.029	20.378	81.201	28.222	85.465	37.241	**40**
35	10.000	0.048	19.993	0.381	29.950	1.284	39.792	3.036	49.366	5.898	58.432	10.093	66.647	15.770	73.566	22.963	78.673	31.532	81.429	41.112	**35**
33	10.000	0.051	19.993	0.404	29.944	1.362	39.766	3.219	49.287	6.249	58.239	10.679	66.239	16.653	72.798	24.173	77.357	33.042	79.354	42.804	**33**
30																					**30**
25																					**25**
23																					**23**
20																					**20**
15																					**15**
14																					**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls= 105 metre

R_C	Length of Transition Curve to Chord Points in Metre											L.T.	S.T.	L.C.	Θ_s	s	K	R_C
	10.5	21.0	31.5	42.0	52.5	63.0	73.5	84.0	94.5	105.0								
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10								
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″		metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 14	0 0 57	0 2 9	0 3 51	0 6 0	0 8 39	0 11 47	0 15 24	0 19 29	0 24 3		70.002	35.001	104.998	1 12 11	0.184	52.499	2500
2200	0 0 16	0 1 5	0 2 27	0 4 22	0 6 50	0 9 50	0 13 23	0 17 30	0 22 8	0 27 20		70.002	35.002	104.997	1 22 2	0.209	52.499	2200
2000	0 0 18	0 1 12	0 2 42	0 4 48	0 7 31	0 10 49	0 14 44	0 19 15	0 24 21	0 30 4		70.003	35.002	104.997	1 30 14	0.230	52.499	2000
1800	0 0 20	0 1 20	0 3 0	0 5 20	0 8 21	0 12 1	0 16 22	0 21 23	0 27 4	0 33 25		70.003	35.003	104.996	1 40 16	0.255	52.499	1800
1500	0 0 24	0 1 36	0 3 36	0 6 25	0 10 1	0 14 26	0 19 39	0 25 40	0 32 29	0 40 6		70.004	35.004	104.994	2 0 19	0.306	52.498	1500
1200	0 0 30	0 2 0	0 4 30	0 8 1	0 12 32	0 18 2	0 24 33	0 32 5	0 40 36	0 50 7		70.007	35.006	104.991	2 30 24	0.383	52.497	1200
1000	0 0 36	0 2 24	0 5 24	0 9 37	0 15 2	0 21 39	0 29 28	0 38 30	0 48 43	1 0 9		70.010	35.009	104.987	3 0 28	0.459	52.495	1000
900	0 0 40	0 2 40	0 6 0	0 10 41	0 16 42	0 24 3	0 32 45	0 42 46	0 54 8	1 6 50		70.012	35.011	104.984	3 20 32	0.510	52.494	900
800	0 0 45	0 3 0	0 6 46	0 12 1	0 18 48	0 27 4	0 36 50	0 48 7	1 0 54	1 15 11		70.016	35.014	104.980	3 45 36	0.574	52.492	800
700	0 0 51	0 3 26	0 7 44	0 13 45	0 21 29	0 30 56	0 42 6	0 55 0	1 9 36	1 25 56		70.021	35.019	104.974	4 17 49	0.656	52.490	700
600	0 1 0	0 4 0	0 9 1	0 16 2	0 25 4	0 36 5	0 49 7	1 4 10	1 21 12	1 40 15		70.028	35.026	104.964	5 0 48	0.765	52.487	600
500	0 1 12	0 4 48	0 10 49	0 19 15	0 30 4	0 43 18	0 58 57	1 17 0	1 37 27	2 0 18		70.040	35.037	104.949	6 0 57	0.918	52.481	500
400	0 1 30	0 6 0	0 13 32	0 24 3	0 37 36	0 54 8	1 13 41	1 36 15	2 1 48	2 30 22		70.063	35.058	104.919	7 31 12	1.148	52.470	400
360	0 1 40	0 6 41	0 15 2	0 26 44	0 41 46	1 0 9	1 21 52	1 46 56	2 15 20	2 47 4		70.078	35.071	104 901	8 21 20	1.275	52.463	360
350	0 1 43	0 6 52	0 15 28	0 27 30	0 42 58	1 1 52	1 24 13	1 49 59	2 19 12	2 51 51		70.082	35.075	104.895	8 35 39	1.311	52.460	350
300	0 2 0	0 8 1	0 18 2	0 32 5	0 50 7	1 12 11	1 38 15	2 8 19	2 42 24	3 20 29		70.112	35.102	104.857	10 - 1 36	1.530	52.446	300
250	0 2 24	0 9 37	0 21 39	0 38 30	1 0 9	1 26 37	1 57 54	2 33 59	3 14 52	4 0 33		70.161	35.148	104.793	12 1 55	1.835	52.422	250
230	0 2 36	0 10 27	0 23 32	0 41 51	1 5 23	1 34 9	2 8 9	2 47 22	3 31 48	4 21 27		70.191	35.175	104.756	13 4 42	1.994	52.408	230
200	0 3 0	0 12 1	0 27 4	0 48 7	1 15 11	1 48 16	2 27 22	3 12 28	4 3 33	5 0 37		70 252	35.231	104.677	15 2 24	2.291	52.377	200
170	0 3 32	0 14 9	0 31 50	0 56 37	1 28 28	2 7 23	2 53 22	3 46 24	4 46 29	5 53 35		70.349	35.321	104.551	17 41 39	2.693	52.329	170
155	0 3 52	0 15 31	0 34 55	1 2 5	1 37 1	2 19 42	3 10 8	4 8 18	5 14 11	6 27 45		70.419	35.387	104.459	19 24 23	2.952	52.293	155
125	0 4 48	0 19 15	0 43 18	1 17 0	2 0 18	2 53 13	3 55 44	5 7 50	6 29 27	8 0 33		70.643	35.599	104.164	24 3 51	3 652	52.178	125
100	0 6 0	0 24 3	0 54 8	1 36 15	2 30 22	3 36 30	4 54 37	6 24 39	8 6 33	10 0 11		71.001	33.946	103.683	30 4 49	4.549	51.985	100
90	0 6 41	0 26 44	1 0 9	1 46 56	2 47 4	4 0 33	5 27 18	7 7 18	9 0 24	11 6 30		71.234	36.175	103.366	33 25 21	5.043	51.854	90
80	0 7 31	0 30 4	1 7 40	2 0 18	3 7 57	4 30 35	6 8 9	8 0 33	10 7 39	12 29 14		71.558	36.502	102.917	37 36 1	5.655	51.666	80
70	0 8 35	0 34 22	1 17 20	2 17 29	3 34 47	5 9 12	7 0 38	9 8 57	11 33 56	14 15 17		72.028	36.990	102.251	42 58 18	6.432	51 379	70
60	0 10 1	0 40 6	1 30 14	2 40 24	4 10 34	6 0 39	8 10 32	10 39 59	13 28 40	16 36 3		72.750	37.770	101.202	30 8 1	7.450	50.908	60
55	0 10 56	0 43 45	1 38 26	2 54 58	4 33 19	6 33 23	8 54 58	11 37 49	14 41 27	18 5 12		73.266	38.351	100.434	34 41 29	8.086	50.550	55
50	0 12 1	0 48 7	1 48 16	3 12 28	5 0 37	7 12 37	9 48 14	12 47 4	16 8 31	19 51 40		73.946	39.144	99.403	60 9 38	8.834	50 053	50
45	0 13 22	0 53 28	2 0 18	3 33 50	5 33 59	8 0 33	10 53 15	14 11 31	17 54 31	22 0 58		74.871	40.276	97.976	66 50 42	9 726	49.333	45
40	0 15 2	1 0 9	2 15 20	4 0 33	6 15 39	9 0 25	12 14 21	15 56 43	20 6 16	24 41 8		76.189	41.978	95.921	75 12 2	10.803	48.239	40
35	0 17 11	1 8 45	2 34 40	4 34 53	7 9 12	10 17 15	13 58 20	18 11 18	22 54 15	28 4 18		78.209	44.755	92.816	85 56 37	12.119	46.463	35
33																		33
30																		30
25																		25
23																		23
20																		20
15																		15
14																		14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=105 metre

R_C	Length of Transition Curve to Chord Points in Metre																				R_C
	10.5		21.0		31.5		42.0		52.5		63.0		73.5		84.0		94.5		105.0		
metre	X 1	Y 1	X 2	Y 2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	10.500	0.001	21.000	0.006	31.500	0.020	42.000	0.047	52.500	0.092	63.000	0.159	73.499	0.252	83.998	0.376	94.497	0.536	104.995	0.735	**2500**
2200	10.500	0.001	21.000	0.007	31.500	0.023	42.000	0.053	52.500	0.104	63.000	0.180	73.499	0.286	83.998	0.428	94.496	0.609	104.994	0.835	**2200**
2000	10.500	0.001	21.000	0.007	31.500	0.025	42.000	0.059	52.500	0.115	62.999	0.198	73.499	0.315	83.998	0.470	94.496	0.670	104.993	0.919	**2000**
1800	10.500	0.001	21.000	0.008	31.500	0.028	42.000	0.065	52.500	0.128	62.999	0.220	73.499	0.350	83.997	0.523	94.495	0.744	104.991	1.021	**1800**
1500	10.500	0.001	21.000	0.010	31.500	0.033	42.000	0.078	52.500	0.153	62.999	0.265	73.498	0.420	83.996	0.627	94.492	0.893	104.987	1.225	**1500**
1200	10.500	0.002	21.000	0.012	31.500	0.041	42.000	0.098	52.499	0.191	62.998	0.331	73.497	0.525	83.993	0.784	94.488	1.116	104.980	1.531	**1200**
1000	10.500	0.002	21.000	0.015	31.500	0.050	42.000	0.118	52.499	0.230	62.998	0.397	73.495	0.630	83.991	0.941	94.483	1.339	104.971	1.837	**1000**
900	10.500	0.002	21.000	0.016	31.500	0.055	42.000	0.131	52.499	0.255	62.997	0.441	73.494	0.700	83.988	1.045	94.479	1.488	104.964	2.041	**900**
800	10.500	0.002	21.000	0.018	31.500	0.062	42.000	0.147	52.499	0.287	62.996	0.496	73.492	0.788	83.985	1.176	94.473	1.674	104.955	2.296	**800**
700	10.500	0.003	21.000	0.021	31.500	0.071	41.999	0.168	52.498	0.328	62.995	0.567	73.490	0.900	83.981	1.344	94.465	1.913	104.941	2.624	**700**
600	10.500	0.003	21.000	0.024	31.500	0.083	41.999	0.196	52.497	0.383	62.994	0.661	73.486	1.050	83.974	1.568	94.453	2.232	104.920	3.061	**600**
500	10.500	0.004	21.000	0.029	31.500	0.099	41.999	0.235	52.496	0.459	62.991	0.794	73.481	1.260	83.962	1.881	94.432	2.678	104.884	3.672	**500**
400	10.500	0.005	21.000	0.037	31.500	0.124	41.998	0.294	52.494	0.574	62.986	0.992	73.470	1.575	83.941	2.351	94.393	3.346	104.819	4.588	**400**
360	10.500	0.005	21.000	0.041	31.499	0.138	41.998	0.327	52.493	0.638	62.983	1.102	73.462	1.750	83.927	2.612	94.368	3.717	104.777	5.096	**360**
350	10.500	0.005	21.000	0.042	31.499	0.142	41.998	0.336	52.493	0.656	62.982	1.134	73.460	1.800	83.923	2.686	94.361	3.823	104.764	5.242	**350**
300	10.500	0.006	21.000	0.049	31.499	0.165	41.997	0.392	52.490	0.766	62.975	1.323	73.446	2.100	83.895	3.133	94.310	4.459	104.679	6.112	**300**
250	10.500	0.007	21.000	0.059	31.499	0.198	41.995	0.470	52.486	0.919	62.964	1.587	73.422	2.519	83.848	3.758	94.227	5.347	104.538	7.327	**250**
230	10.500	0.008	21.000	0.064	31.499	0.216	41.994	0.511	52.483	0.998	62.957	1.725	73.408	2.738	83.738	4.084	94.177	5.810	104.454	7.959	**230**
200	10.500	0.009	21.000	0.073	31.498	0.248	41.993	0.588	52.477	1.148	62.944	1.983	73.378	3.148	83.772	4.695	94.074	6.676	104.279	9.142	**200**
170	10.500	0.011	21.000	0.086	31.498	0.292	41.990	0.692	52.469	1.351	62.922	2.333	73.332	3.701	83.672	5.519	93.910	7.844	104.003	10.735	**170**
155	10.500	0.012	21.000	0.095	31.497	0.320	41.988	0.759	52.462	1.481	62.906	2.558	73.298	4.058	83.606	6.049	93.791	8.596	103.802	11.758	**155**
125	10.500	0.015	20.999	0.118	31.495	0.397	41.981	0.940	52.442	1.836	62.856	3.170	73.189	5.027	83.395	7.488	93.412	10.628	103.163	14.516	**125**
100	10.500	0.018	20.999	0.147	31.493	0.496	41.970	1.175	52.410	2.294	62.775	3.959	73.015	6.273	83.057	9.332	92.805	13.223	102.143	18.016	**100**
90	10.500	0.020	20.999	0.163	31.491	0.551	41.963	1.306	52.388	2.548	62.723	4.396	72.902	6.962	82.837	10.350	92.412	14.648	101.483	19.926	**90**
80	10.500	0.023	20.999	0.184	31.489	0.620	41.954	1.469	52.359	2.866	62.649	4.942	72.744	7.820	82.530	11.613	91.865	16.409	100.567	22.272	**80**
70	10.500	0.026	20.998	0.210	31.486	0.709	41.940	1.678	52.316	3.273	62.542	5.641	75.564	8.917	83.085	13.220	91.072	18.638	99.246	25.214	**70**
60	10.500	0.031	20.997	0.245	31.480	0.827	41.918	1.957	52.249	3.815	62.378	6.568	72.160	10.367	81.404	15.332	89.862	21.537	97.241	28.990	**60**
55	10.500	0.033	20.997	0.267	31.477	0.902	41.902	2.135	52.202	4.159	62.260	7.156	71.908	11.281	80.919	16.655	89.005	23.335	95.828	31.297	**55**
50	10.500	0.037	20.996	0.294	31.472	0.992	41.882	2.347	52.139	4.571	62.106	7.857	71.578	12.369	80.285	18.218	87.889	25.438	94.000	33.956	**50**
45	10.500	0.041	20.995	0.327	31.465	1.102	41.854	2.607	52.055	5.073	61.898	8.709	71.134	13.682	79.436	20.089	86.403	27.922	91.581	37.031	**45**
40	10.500	0.046	20.994	0.367	31.456	1.239	41.815	2.931	51.938	5.698	61.608	9.765	70.518	15.297	78.263	22.361	84.364	30.880	88.297	40.586	**40**
35	10.500	0.052	20.992	0.420	31.443	1.416	41.759	3.346	51.767	6.497	61.188	11.106	69.627	17.324	76.582	25.162	81.471	34.422	83.708	44.643	**35**
33																					**33**
30																					**30**
25																					**25**
23																					**23**
20																					**20**
15																					**15**
14																					**14**

Appendix 4

TABLE II : SETOUT TABLE FOR TRANSITION CURVES

Ls = 110 metre

R_C	Length of Transition Curve to Chord Points in Metre									L.T.	S.T.	L.C.	Θ_s	s	K	R_C	
	11.0	22.0	33.0	44.0	55.0	66.0	77.0	88.0	99.0	110.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 15	0 1 0	0 2 16	0 4 2	0 6 18	0 9 4	0 12 21	0 16 8	0 20 25	0 25 12	73.335	36.668	109.998	1 15 37	0.202	54.999	2500
2200	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	73.336	36.669	109.997	1 25 56	0.229	54.999	2200
2000	0 0 18	0 1 15	0 2 50	0 5 2	0 7 52	0 11 20	0 15 26	0 20 10	0 25 31	0 31 30	73.336	36.669	109.996	1 34 32	0.252	54.999	2000
1800	0 0 21	0 1 24	0 3 9	0 5 36	0 8 45	0 12 36	0 17 9	0 22 24	0 28 21	0 35 0	73.337	36.670	109.995	1 45 2	0.280	54.998	1800
1500	0 0 25	0 1 40	0 3 46	0 6 43	0 10 30	0 15 7	0 20 35	0 26 53	0 34 2	0 42 0	73.338	36.671	109.993	2 6 3	0.336	54.998	1500
1200	0 0 31	0 2 6	0 4 43	0 8 24	0 13 7	0 18 54	0 25 44	0 33 36	0 42 32	0 52 31	73.341	36.674	109.990	2 37 33	0.420	54.996	1200
1000	0 0 37	0 2 31	0 5 40	0 10 5	0 15 45	0 22 41	0 30 52	0 40 20	0 51 2	1 3 1	73.345	36.677	109.985	3 9 4	0.504	54.994	1000
900	0 0 42	0 2 48	0 6 18	0 11 12	0 17 30	0 25 12	0 34 18	0 44 49	0 56 43	1 10 1	73.348	36.680	109.982	3 30 5	0.560	54.993	900
800	0 0 47	0 3 9	0 7 5	0 12 36	0 19 41	0 28 21	0 38 36	0 50 25	1 3 48	1 18 46	73.351	36.683	109.977	3 56 20	0.630	54.991	800
700	0 0 54	0 3 36	0 8 6	0 14 24	0 22 30	0 32 24	0 44 7	0 57 37	1 12 55	1 30 1	73.357	36.688	109.970	4 30 6	0.720	54.989	700
600	0 1 3	0 4 12	0 9 27	0 16 48	0 26 15	0 37 48	0 51 28	1 7 13	1 25 4	1 45 2	73.366	36.696	109.959	5 15 7	0.840	54.985	600
500	0 1 15	0 5 2	0 11 20	0 20 10	0 31 30	0 45 22	1 1 45	1 20 40	1 42 5	2 6 2	73.380	36.709	109.941	6 18 9	1.008	54.978	500
400	0 1 34	0 6 18	0 14 10	0 25 12	0 39 23	0 56 43	1 17 12	1 40 50	2 7 36	2 37 32	73.406	36.733	109.907	7 52 41	1.260	54.965	400
360	0 1 45	0 7 0	0 15 45	0 28 0	0 43 46	1 3 1	1 25 46	1 52 2	2 21 47	2 55 2	73.423	36.748	109.886	8 45 12	1.399	54.957	360
350	0 1 48	0 7 12	0 16 12	0 28 48	0 45 1	1 4 49	1 28 13	1 55 14	2 25 50	3 0 2	73.428	36.753	109.879	9 0 13	1.439	54.954	350
300	0 2 6	0 8 24	0 18 54	0 33 36	0 52 31	1 15 37	1 42 56	2 14 26	2 50 8	3 30 1	73.462	36.784	109.835	10 30 15	1.679	54.938	300
250	0 2 31	0 10 5	0 22 41	0 40 20	1 3 1	1 30 45	2 3 31	2 41 19	3 24 8	4 11 59	73.519	36.837	109.762	12 36 18	2.013	54.910	250
230	0 2 44	0 10 57	0 24 39	0 43 50	1 8 30	1 38 38	2 14 15	2 55 20	3 41 53	4 33 53	73.553	36.868	109.719	13 42 4	2.188	54.894	230
200	0 3 9	0 12 36	0 28 21	0 50 25	1 18 46	1 53 26	2 34 23	3 21 37	4 15 8	5 14 55	73.623	36.933	109.628	15 45 22	2.514	54.859	200
170	0 3 42	0 14 49	0 33 21	0 59 19	1 32 40	2 13 27	3 1 37	3 57 11	5 0 7	6 10 24	73.734	37.036	109.484	18 32 12	2.955	54.803	170
155	0 4 3	0 16 15	0 36 35	1 5 3	1 41 38	2 26 21	3 19 11	4 20 7	5 29 7	6 46 10	73.815	37.112	109.378	20 19 50	3.238	54.762	155
125	0 5 2	0 20 10	0 45 22	1 20 40	2 6 2	3 1 28	4 6 57	5 22 28	6 47 57	8 23 22	74.072	37.356	109.038	25 12 36	4.006	54.628	125
100	0 6 18	0 25 12	0 56 43	1 40 50	2 37 32	3 46 48	5 8 38	6 42 56	8 29 38	10 28 37	74 484	37.757	108.483	31 30 45	4.988	54.404	100
90	0 7 0	0 28 0	1 3 1	1 52 2	2 55 2	4 11 59	5 42 52	7 27 35	9 26 2	11 38 2	74.751	38.023	108.116	35 0 50	5.528	54.252	90
80	0 7 52	9 31 30	1 10 54	2 6 2	3 16 54	4 43 28	6 25 39	8 23 22	10 36 26	13 4 37	75.123	38.402	107.597	39 23 27	6.197	54.032	80
70	0 9 0	0 36 0	1 21 1	2 24 2	3 45 1	5 23 54	7 20 37	9 34 59	12 6 46	14 55 35	75.663	38.969	106.827	45 1 5	7.046	53.696	70
60	0 10 30	0 42 0	1 34 31	2 48 2	4 22 29	6 17 48	8 33 49	11 10 17	14 6 49	17 22 47	76.492	39.879	105.610	52 31 16	8.155	53.142	60
55	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58	77.086	40.559	104.718	57 17 44	8.846	52.719	55
50	0 12 36	0 50 25	1 53 26	3 21 37	5 14 55	7 33 10	10 16 7	13 23 17	16 54 0	20 47 12	77.869	41.493	103.520	63 1 31	9.659	52.130	50
45	0 14 0	0 56 1	2 6 2	3 44 1	5 49 51	8 23 22	11 24 10	14 51 38	18 44 49	23 2 11	78.939	42.830	101.860	70 1 41	10.624	51.274	45
40	0 15 45	1 3 1	2 21 47	4 11 59	6 33 30	9 26 2	12 49 3	16 41 40	21 2 27	25 49 13	80.475	44.861	99.466	78 46 54	11.786	49.967	40
35																	35
33																	33
30																	30
25																	25
23																	23
20																	20
15																	15
14																	14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=110 metre

R_C	Length of Transition Curve to Chord Points in Metre																						R_C
	11.0		22.0		33.0		44.0		55.0		66.0		77.0		88.0		99.0		110.0				
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10			metre
2500	11.000	0.001	22.000	0.006	33.000	0.022	44.000	0.052	55.000	0.101	66.000	0.174	76.999	0.277	87.998	0.413	98.997	0.588	109.995	0.807			**2500**
2200	11.000	0.001	22.000	0.007	33.000	0.025	44.000	0.059	55.000	0.115	65.999	0.198	76.999	0.314	87.998	0.469	98.996	0.668	109.993	0.917			**2200**
2000	11.000	0.001	22.000	0.008	33.000	0.027	44.000	0.065	55.000	0.126	65.999	0.218	76.999	0.346	87.997	0.516	98.995	0.735	109.992	1.008			**2000**
1800	11.000	0.001	22.000	0.009	33.000	0.030	44.000	0.072	55.000	0.140	65.999	0.242	76.998	0.384	87.997	0.574	98.994	0.817	109.990	1.120			**1800**
1500	11.000	0.001	22.000	0.011	33.000	0.036	44.000	0.086	55.000	0.168	65.999	0.290	76.998	0.461	87.995	0.688	98.991	0.980	109.985	1.344			**1500**
1200	11.000	0.002	22.000	0.013	33.000	0.045	44.000	0.108	54.999	0.210	65.998	0.363	76.996	0.576	87.992	0.860	98.986	1.225	109.977	1.680			**1200**
1000	11.000	0.002	22.000	0.016	33.000	0.054	44.000	0.129	54.999	0.252	65.997	0.436	76.994	0.692	87.989	1.032	98.980	1.470	109.967	2.016			**1000**
900	11.000	0.002	22.000	0.018	33.000	0.060	44.000	0.143	54.999	0.280	65.997	0.484	76.993	0.769	87.987	1.147	98.976	1.633	109.959	2.240			**900**
800	11.000	0.003	22.000	0.020	33.000	0.068	43.999	0.161	54.998	0.315	65.996	0.544	76.991	0.865	87.983	1.290	98.969	1.837	109.948	2.520			**800**
700	11.000	0.003	22.000	0.023	33.000	0.078	43.999	0.184	54.998	0.360	65.995	0.622	76.989	0.988	87.978	1.475	98.960	2.100	109.932	2.880			**700**
600	11.000	0.003	22.000	0.027	33.000	0.091	43.999	0.215	54.997	0.420	65.993	0.726	76.984	1.153	87.970	1.720	98.945	2.449	109.908	3.359			**600**
500	11.000	0.004	22.000	0.032	33.000	0.109	43.999	0.258	54.996	0.504	65.990	0.871	76.978	1.383	87.956	2.064	98.921	2.939	109.867	4.030			**500**
400	11.000	0.005	22.000	0.040	32.999	0.136	43.998	0.323	54.993	0.630	65.984	1.089	76.965	1.729	87.932	2.580	98.877	3.672	109.792	5.035			**400**
360	11.000	0.006	22.000	0.045	32.999	0.151	43.997	0.359	54.992	0.700	65.980	1.210	76.957	1.921	87.916	2.866	98.848	4.079	109.744	5.593			**360**
350	11.000	0.006	22.000	0.046	32.999	0.156	43.997	0.369	54.992	0.720	65.979	1.244	76.954	1.975	87.911	2.948	98.840	4.196	109.729	5.752			**350**
300	11.000	0.007	22.000	0.054	32.999	0.181	43.996	0.439	54.988	0.840	65.971	1.452	76.938	2.304	87.879	3.438	98.782	4.893	109.631	6.706			**300**
250	11.000	0.008	22.000	0.065	32.999	0.218	43.995	0.516	54.983	1.008	65.959	1.742	76.911	2.765	87.826	4.124	98.686	5.867	109.469	8.039			**250**
230	11.000	0.009	22.000	0.070	32.998	0.237	43.994	0.561	54.980	1.096	65.951	1.893	76.894	3.005	87.794	4.482	98.629	6.375	109.373	8.732			**230**
200	11.000	0.010	22.000	0.081	32.998	0.272	43.991	0.645	54.974	1.260	65.935	2.176	76.860	3.454	87.728	5.151	98.510	7.325	109.171	10.029			**200**
170	11.000	0.012	22.000	0.095	32.997	0.320	43.988	0.759	54.964	1.482	65.911	2.567	76.807	4.062	87.623	6.055	98.322	8.606	108.854	11.774			**170**
155	11.000	0.013	22.000	0.104	32.997	0.351	43.986	0.832	54.957	1.615	65.892	2.807	76.768	4.453	87.547	6.637	98.185	9.429	108.623	12.894			**155**
125	11.000	0.016	21.999	0.129	32.995	0.436	43.978	1.032	54.933	2.015	65.835	3.479	76.643	5.515	87.305	8.214	97.750	11.655	107.889	15.912			**125**
100	11.000	0.020	21.999	0.161	32.992	0.544	43.966	1.290	54.896	2.517	65.742	4.344	76.443	6.881	86.916	10.234	97.053	14.494	106.719	19.735			**100**
90	11.000	0.022	21.999	0.179	32.990	0.605	43.958	1.433	54.872	2.796	65.681	4.823	76.312	7.637	86.663	11.348	96.602	16.051	105.962	21.817			**90**
80	11.000	0.025	21.998	0.202	32.987	0.680	43.947	1.612	54.838	3.144	65.597	5.421	76.131	8.577	86.312	12.729	95.974	17.974	104.913	24.370			**80**
70	11.000	0.029	21.998	0.230	32.984	0.778	43.931	1.842	54.788	3.591	65.474	6.187	75.866	9.778	85.801	14.486	95.065	20.402	103.400	27.564			**70**
60	11.000	0.034	21.997	0.269	32.978	0.907	43.905	2.148	54.712	4.186	65.285	7.204	75.461	11.364	85.019	16.790	93.680	23.554	101.110	31.647			**60**
55	11.000	0.037	21.996	0.293	32.973	0.989	43.887	2.342	54.657	4.563	65.150	7.847	75.172	12.363	84.463	18.231	92.699	25.503	99.498	34.130			**55**
50	11.000	0.040	21.996	0.323	32.968	1.088	43.864	2.576	54.586	5.014	64.973	8.615	74.793	13.550	83.738	19.931	91.424	27.777	97.415	36.979			**50**
45	11.000	0.045	21.995	0.358	32.960	1.209	43.832	2.860	54.489	5.565	64.734	9.547	74.284	14.982	82.766	21.962	89.727	30.453	94.665	40.254			**45**
40	11.000	0.050	21.993	0.403	32.949	1.360	43.788	3.216	54.354	6.249	64.401	10.701	73.577	16.740	81.425	24.420	87.405	33.623	90.944	44.004			**40**
35																							**35**
33																							**33**
30																							**30**
25																							**25**
23																							**23**
20																							**20**
15																							**15**
14																							**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 115 metre

R_C	Length of Transition Curve to Chord Points in Metre										L.T.	S.T.	L.C.	Θ_s	s	K	R_C
	11.5	23.0	34.5	46.0	57.5	69.0	80.5	92.0	103.5	115.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 15	0 1 3	0 2 22	0 4 13	0 6 35	0 9 29	0 12 54	0 16 52	0 21 20	0 26 21	76.669	38.335	114.997	1 19 4	0.220	57.499	**2500**
2200	0 0 17	0 1 11	0 2 41	0 4 47	0 7 29	0 10 46	0 14 40	0 19 10	0 24 15	0 29 56	76.669	38.336	114.997	1 29 51	0.250	57.499	**2200**
2000	0 0 19	0 1 19	0 2 57	0 5 16	0 8 14	0 11 51	0 16 8	0 21 5	0 26 41	0 32 56	76.670	38.336	114.996	1 38 50	0.275	57.498	**2000**
1800	0 0 21	0 1 27	0 3 17	0 5 51	0 9 9	0 13 10	0 17 56	0 23 25	0 29 39	0 36 36	76.671	38.337	114.995	1 49 49	0.306	57.498	**1800**
1500	0 0 26	0 1 45	0 3 57	0 7 1	0 10 58	0 15 48	0 21 31	0 28 6	0 35 34	0 43 55	76.673	38.339	114.993	2 11 46	0.367	57.497	**1500**
1200	0 0 32	0 2 11	0 4 56	0 8 47	0 13 43	0 19 46	0 26 54	0 35 8	0 44 28	0 54 54	76.676	38.342	114.988	2 44 43	0.459	57.496	**1200**
1000	0 0 39	0 2 38	0 5 55	0 10 32	0 16 28	0 23 43	0 32 17	0 42 10	0 53 22	1 5 53	76.680	38.345	114.983	3 17 40	0.551	57.494	**1000**
900	0 0 43	0 2 55	0 6 35	0 11 42	0 18 18	0 26 21	0 35 52	0 46 51	0 59 17	1 13 12	76.683	38.348	114.979	3 39 38	0.612	57.492	**900**
800	0 0 49	0 3 17	0 7 24	0 13 10	0 20 35	0 29 39	0 40 21	0 52 42	1 6 42	1 22 21	76.687	38.352	114.974	4 7 5	0.689	57.490	**800**
700	0 0 56	0 3 45	0 8 28	0 15 3	0 23 31	0 33 53	0 46 7	1 0 14	1 16 14	1 34 7	76.694	38.358	114.966	4 42 23	0.787	57.487	**700**
600	0 1 5	0 4 23	0 9 53	0 17 34	0 27 27	0 39 32	0 53 48	1 10 16	1 28 56	1 49 48	76.704	38.367	114.953	5 29 27	0.918	57.482	**600**
500	0 1 19	0 5 16	0 11 51	0 21 5	0 32 56	0 47 26	1 4 34	1 24 20	1 46 44	2 11 45	76.720	38.382	114.932	6 35 20	1.102	57.475	**500**
400	0 1 38	0 6 35	0 14 49	0 26 21	0 41 10	0 59 17	1 20 42	1 45 25	2 13 24	2 44 41	76.750	38.409	114.894	8 14 10	1.377	57.460	**400**
360	0 1 49	0 7 19	0 16 28	0 29 17	0 45 45	1 5 53	1 29 40	1 57 7	2 28 13	3 2 59	76.769	38.427	114.869	9 9 5	1.529	57.451	**360**
350	0 1 52	0 7 31	0 16 56	0 30 7	0 47 3	1 7 46	1 32 14	2 0 28	2 32 27	3 8 12	76.775	38.432	114.862	9 24 46	1.573	57.448	**350**
300	0 2 11	0 8 47	0 19 46	0 35 8	0 54 54	1 19 3	1 47 36	2 20 32	2 57 52	3 39 33	76.814	38.468	114.812	10 58 54	1.834	57.429	**300**
250	0 2 38	0 10 32	0 23 43	0 42 10	1 5 53	1 34 52	2 9 7	2 48 38	3 33 25	4 23 26	76.879	38.528	114.728	13 10 40	2.200	57.397	**250**
230	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	76.917	38.563	114.679	14 19 26	2.390	57.378	**230**
200	0 3 17	0 13 10	0 29 39	0 52 42	1 22 21	1 58 35	2 41 24	3 30 47	4 26 43	5 29 13	76.998	38.638	114.574	16 28 21	2.747	57 338	**200**
170	0 3 52	0 15 30	0 34 52	1 2 0	1 36 53	2 19 30	3 9 52	4 7 57	5 13 44	6 27 12	77.124	38.756	114.409	19 22 46	3.228	57.274	**170**
155	0 4 15	0 17 0	0 38 15	1 8 0	1 46 16	2 33 0	3 28 14	4 31 55	5 44 3	7 4 36	77.217	38.843	114.288	21 15 17	3.538	57.227	**155**
125	0 5 16	0 21 5	0 47 26	1 24 20	2 11 45	3 9 43	4 18 10	5 37 6	7 6 27	8 46 10	77 510	39.123	113.899	26 21 21	4.375	57 073	**125**
100	0 6 35	0 26 21	0 59 17	1 45 25	2 44 41	3 57 7	5 22 38	7 1 12	8 52 43	10 57 2	77.980	39.583	113.262	32 56 42	5.446	56.814	**100**
90	0 7 19	0 29 17	1 5 53	1 57 7	3 2 59	4 23 26	5 58 26	7 47 53	9 51 39	12 9 33	78.285	39.889	112.841	36 36 20	6.034	56.639	**90**
80	0 8 14	0 32 56	1 14 7	2 11 45	3 25 51	4 56 20	6 43 9	8 46 10	11 5 12	13 39 58	78 709	40.325	112.245	41 10 52	6 762	56 384	**80**
70	0 9 24	0 37 39	1 24 42	2 30 35	3 55 14	5 38 36	7 40 35	10 1 0	12 39 33	15 35 49	79 325	40.981	111.358	47 3 51	7.685	55.992	**70**
60	0 10 58	0 43 55	1 38 49	2 55 40	4 34 24	6 34 56	8 57 5	11 40 34	14 44 54	18 9 26	80.272	42.036	109.956	54 54 30	8.889	55.344	**60**
55	0 11 58	0 47 55	1 47 48	3 11 38	4 59 19	7 10 45	9 45 42	12 43 47	16 4 23	19 46 37	80.952	42.829	108 927	59 54 0	9.637	54.847	**55**
50	0 13 10	0 52 42	1 58 35	3 30 47	5 29 13	7 53 43	10 43 58	13 59 28	17 39 24	21 42 33	81.850	43.922	107.543	65 53 24	10.515	54.153	**50**
45	0 14 38	0 58 34	2 11 45	3 54 11	6 5 44	8 46 10	11 55 4	15 31 42	19 34 59	24 3 10	83.082	45.497	105.623	73 12 40	11 555	53.142	**45**
40	0 16 28	1 5 53	2 28 13	4 23 26	6 51 21	9 51 39	13 23 43	17 26 31	21 58 26	26 56 57	84.869	47.911	102.854	82 21 45	12.802	51.591	**40**
35																	**35**
33																	**33**
30																	**30**
25																	**25**
23																	**23**
20																	**20**
15																	**15**
14																	**14**

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 115 metre

R_C	Length of Transition Curve to Chord Points in Metre										R_C
	11.0	23.0	34.5	46.0	57.5	69.0	80.5	92.0	103.5	115.0	
metre	X 1 Y 1	X 2 Y2	X 3 Y 3	X 4 Y 4	X 5 Y 5	X 6 Y 6	X 7 Y 7	X 8 Y 8	X 9 Y 9	X 10 Y 10	metre
2500	11.500 0.001	23.000 0.007	34.500 0.024	46.000 0.056	57.500 0.110	69.000 0.190	80.499 0.302	91.998 0.451	103.496 0.643	114.994 0.882	**2500**
2200	11.500 0.001	23.000 0.008	34.500 0.027	46 000 0.064	57.500 0.125	68.999 0.216	80.499 0.344	91.997 0.513	103.495 0.730	114.992 1.002	**2200**
2000	11 500 0 001	23.000 0.009	34.500 0.030	46 000 0 071	57.500 0.138	68.999 0.238	80.498 0.378	91.997 0.564	103.494 0.803	114.990 1.102	**2000**
1800	11.500 0.001	23.000 0.010	34.500 0.033	46.000 0.078	57.500 0.153	68.999 0.264	80 498 0.420	91.996 0.627	103.493 0.893	114.988 1.224	**1800**
1500	11.500 0.001	23.000 0.012	34.500 0.040	46.000 0.094	57.499 0.184	68.999 0.317	80 497 0.504	91.994 0.752	103.490 1.071	114.983 1.469	**1500**
1200	11.500 0.002	23.000 0.015	34.500 0.050	46.000 0.118	57.499 0.230	68.998 0.397	80.496 0.630	91.991 0.940	103.484 1.339	114.974 1.837	**1200**
1000	11.500 0.002	23.000 0 018	34.500 0.060	46.000 0.141	57.499 0.276	68.997 0.476	80.494 0.756	91.988 1.128	103.478 1.607	114.962 2.204	**1000**
900	11.500 0.002	23.000 0.020	34.500 0.066	46.000 0.157	57.499 0.306	68.996 0.529	80.492 0.840	91.985 1.254	103.472 1.785	114.953 2.448	**900**
800	11 500 0.003	23.000 0.022	34.500 0.074	45.999 0.176	57.498 0.344	68.995 0.595	80.490 0.945	91.981 1.410	103.465 2.008	114.941 2.754	**800**
700	11.500 0.003	23.000 0.025	34.500 0.085	45.999 0.202	57.498 0.394	68.994 0.680	80.487 1.080	91.975 1.612	103.454 2.295	114.922 3.147	**700**
600	11.500 0 004	23.000 0.029	34.500 0.099	45.999 0.235	57.497 0.459	68.992 0.793	80.482 1.260	91.965 1.880	103.438 2.677	114.894 3.671	**600**
500	11.500 0.004	23.000 0.035	34.500 0.119	45.998 0.282	57.495 0.551	68.988 0.952	80.474 1.512	91.950 2.256	103.410 3.212	114.848 4.404	**500**
400	11.500 0.006	23.000 0.044	34.499 0.149	45.998 0.353	57.493 0.689	68.982 1.190	80.460 1.889	91.922 2.820	103.360 4.013	114.763 5.502	**400**
360	11.500 0.006	23.000 0.049	34.499 0.165	45.997 0.392	57.491 0.765	68.977 1.322	80.451 2.099	91.904 3.132	103.327 4.458	114.707 6.112	**360**
350	11.500 0.006	23.000 0.050	34.499 0.170	45.997 0.403	57.490 0.787	68.976 1.360	80.448 2.159	91.898 3.222	103.317 4.585	114.690 6.285	**350**
300	11.500 0.007	23.000 0.059	34.499 0.198	45.996 0.470	57.487 0.918	68.967 1.586	80.429 2.519	91.862 3.758	103.251 5.347	114.578 7.328	**300**
250	11.500 0.009	23.000 0.071	34.499 0.238	45.994 0.564	57.481 1.102	68.953 1.903	80.398 3.021	91.801 4.507	103.141 6.411	114.393 8.783	**250**
230	11.500 0.010	23.000 0.077	34.498 0.259	45.993 0.613	57.478 1.198	68.944 2.069	80.379 3.284	91.765 4.898	103.076 6 966	114.283 9.541	**230**
200	11.500 0 011	23.000 0.088	34.498 0.298	45.990 0.705	57.470 1.377	68.926 2.379	80.340 3.775	91.689 5.629	102.940 8.003	114.053 10.956	**200**
170	11.500 0.013	23.000 0.104	34.497 0.350	45.987 0.830	57.459 1.620	68.898 2.798	80.279 4 439	91.570 6.616	102.726 9.401	113.691 12.860	**170**
155	11.500 0.014	22.999 0.114	34.496 0.384	45.984 0.910	57.451 1.776	68.877 3.068	80.234 4.866	91.483 7.252	102.569 10.300	113.427 14.081	**155**
125	11.500 0.018	22.999 0.141	34.494 0.476	45.975 1.128	57.424 2.202	68.811 3.801	80.092 6.026	91.206 8,973	102.072 12.728	112.590 17.369	**125**
100	11.500 0 022	22.999 0.176	34.491 0.595	45.961 1.410	57.381 2.751	68.705 4.746	79.863 7.518	90.762 11.177	101.277 15.821	111.256 21.527	**100**
90	11.500 0.025	22.999 0.196	34.489 0.661	45.952 1.566	57.353 3.056	68.636 5.270	79.715 8.342	90.474 12.390	100.762 17.515	110.394 23.786	**90**
80	11.500 0.028	22.998 0.220	34.486 0.744	45.939 1.762	57.315 3.436	68.539 5.923	79.507 9.367	90.072 13.895	100.047 19.604	109.199 26.552	**80**
70	11.500 0.031	22.998 0.252	34.481 0.850	45.921 2.013	57.258 3.924	68.399 6.759	79.206 10.676	89.490 15.806	99.011 22.239	107.479 30.003	**70**
60	11.500 0.037	22.997 0.294	34.474 0.991	45.892 2.347	57.171 4.573	68.183 7.868	78.743 12.403	88.599 18.310	97.435 25.650	104.878 34.396	**60**
55	11.500 0.040	22.996 0.321	34.469 1.081	45.871 2.560	57.108 4.985	68.029 8.569	78.413 13.490	87.966 19.872	96.320 27.752	103.051 37.054	**55**
50	11.500 0.044	22.995 0.353	34.463 1.189	45.845 2.815	57.027 5.478	67.827 9.406	77.981 14.781	87.140 21.712	94.873 30.199	100.694 40.090	**50**
45	11.500 0.049	22.994 0.392	34.454 1.321	45.808 3.125	56.916 6.078	67.554 10.421	77.401 16.336	86.035 23.906	92.949 33.067	97.590 43.557	**45**
40	11.500 0.055	22.992 0.441	34.442 1.486	45.757 3.513	56.762 6.825	67.175 11.677	76.597 18.241	84.512 26.553	90.321 36.445	93.401 47.486	**40**
35											**35**
33											**33**
30											**30**
25											**25**
23											**23**
20											**20**
15											**15**
14											**14**

Appendix 4

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 120 metre

R_C	Length of Transition Curve to Chord Points in Metre											L. T.	S. T	L. C.	Θ_s	s	K	R_C
	12.0	24.0	36.0	48.0	60.0	72.0	84.0	96.0	108.0	120.0								
metre	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10		metre	metre	metre		metre	metre	metre
	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″					° ′ ″			
2500	0 0 16	0 1 6	0 2 28	0 4 24	0 6 52	0 9 54	0 13 28	0 17 36	0 22 16	0 27 30		80.002	40.002	119.997	1 22 30	0.240	59.999	2500
2200	0 0 18	0 1 15	0 2 48	0 5 0	0 7 48	0 11 15	0 15 18	0 20 0	0 25 18	0 31 15		80.003	40.003	119.996	1 33 45	0.273	59.999	2200
2000	0 0 20	0 1 22	0 3 5	0 5 30	0 8 35	0 12 22	0 16 50	0 22 0	0 27 50	0 34 22		80.004	40.003	119.995	1 43 7	0.300	59.998	2000
1800	0 0 22	0 1 31	0 3 26	0 6 6	0 9 32	0 13 45	0 18 42	0 24 26	0 30 56	0 38 11		80.005	40.004	119.994	1 54 35	0.333	59.998	1800
1500	0 0 27	0 1 50	0 4 7	0 7 20	0 11 27	0 16 30	0 22 27	0 29 20	0 37 7	0 45 50		80.007	40.006	119.991	2 17 30	0.400	59.997	1500
1200	0 0 34	0 2 17	0 5 9	0 9 10	0 14 19	0 20 37	0 28 4	0 36 40	0 46 24	0 57 17		80.010	40.010	119.987	2 51 53	0.500	59.995	1200
1000	0 0 41	0 2 45	0 6 11	0 11 0	0 17 11	0 24 45	0 33 41	0 44 0	0 55 41	1 8 45		80.015	40.014	119.981	3 26 15	0.600	59.993	1000
900	0 0 45	0 3 3	0 6 52	0 12 13	0 19 5	0 27 30	0 37 25	0 48 53	1 1 52	1 16 23		80.019	40.017	119.976	3 49 10	0.667	59.991	900
800	0 0 51	0 3 26	0 7 44	0 13 45	0 21 29	0 30 56	0 42 6	0 55 0	1 9 36	1 25 56		80.024	40.021	119.970	4 17 49	0.750	59.989	800
700	0 0 58	0 3 55	0 8 50	0 15 42	0 24 33	0 35 21	0 48 7	1 2 51	1 19 33	1 38 12		80.031	40.028	119.961	4 54 39	0.857	59.985	700
600	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34		80.042	40.038	119.947	5 43 46	1.000	59.980	600
500	0 1 22	0 5 30	0 12 22	0 22 0	0 34 22	0 49 30	1 7 22	1 28 0	1 51 22	2 17 29		80.060	40.055	119.923	6 52 31	1.199	59.971	500
400	0 1 43	0 6 52	0 15 28	0 27 30	0 42 58	1 1 52	1 24 13	1 49 59	2 19 12	2 51 51		80.094	40.086	119.880	8 35 39	1.499	59.955	400
360	0 1 54	0 7 38	0 17 11	0 30 33	0 47 44	1 8 45	1 33 34	2 2 13	2 34 40	3 10 56		80.106	40.106	119.852	9 32 57	1 665	59.944	360
350	0 1 57	0 7 51	0 17 40	0 31 25	0 49 6	1 10 43	1 36 15	2 5 42	2 39 5	3 16 23		80.112	40.112	119.843	9 49 19	1.712	59.941	350
300	0 2 17	0 9 10	0 20 37	0 36 40	0 57 17	1 22 30	1 52 17	2 26 39	3 5 35	3 49 6		80.167	40.153	119.786	11 27 32	1.997	59.919	300
250	0 2 45	0 11 0	0 24 45	0 44 0	1 8 45	1 39 0	2 14 44	2 55 58	3 42 41	4 34 53		80.241	40.221	119.691	13 45 3	2.395	59.883	250
230	0 2 59	0 11 57	0 26 54	0 47 49	1 14 43	1 47 36	2 26 27	3 11 16	4 2 2	4 58 45		80.284	40.261	119.635	14 56 48	2.602	59.862	230
200	0 3 26	0 13 45	0 30 56	0 55 0	1 25 56	2 3 44	2 48 25	3 39 56	4 38 19	5 43 30		80.376	40.346	119.516	17 11 19	2.990	59.816	200
170	0 4 2	0 16 10	0 36 23	1 4 42	1 41 6	2 25 34	3 18 7	4 18 43	5 27 22	6 44 0		80.520	40.481	119.328	20 13 19	3.514	59.743	170
155	0 4 26	0 17 44	0 39 55	1 10 58	1 50 53	2 39 39	3 37 17	4 43 44	5 59 0	7 23 0		80.625	40.580	119.190	22 10 44	3.850	59.689	155
125	0 5 30	0 22 0	0 49 30	1 28 0	2 17 29	3 17 57	4 29 23	5 51 44	7 24 57	9 8 57		80 958	40.899	118.747	27 30 7	4.761	59.513	125
100	0 6 52	0 27 30	1 1 52	1 49 59	2 51 51	4 7 25	5 36 39	7 19 28	9 15 47	11 25 26		81.491	41.424	118.021	34 22 38	5.923	59.216	100
90	0 7 38	0 30 33	1 8 45	2 2 13	3 10 56	4 34 53	6 13 59	8 8 10	10 17 15	12 41 2		81.837	41.774	117.540	38 11 49	6.562	59.013	90
80	0 8 35	0 34 22	1 17 20	2 17 29	3 34 47	5 9 12	7 0 38	9 8 57	11 33 56	14 15 17		82.318	42.275	116.859	42 58 18	7.351	58.719	80
70	0 9 49	0 39 17	1 28 23	2 37 7	4 5 27	5 53 18	8 0 33	10 27 0	13 12 18	16 15 59		83.018	43.028	115.844	49 6 38	8.350	58.265	70
60	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58		84.093	44.247	114.238	57 17 44	9.650	57 512	60
55	0 12 30	0 50 0	1 52 29	3 19 57	5 12 19	7 29 26	10 11 3	13 16 43	16 45 45	20 37 7		84.867	45.166	113.056	62 30 16	10.457	56.931	55
50	0 13 45	0 55 0	2 3 44	3 39 56	5 43 30	8 14 15	11 11 48	14 35 36	18 24 42	22 37 44		85.892	46.439	111.467	68 45 17	11.401	56.118	50
45	0 15 16	1 1 6	2 17 29	4 4 22	6 21 36	9 8 57	12 25 55	16 11 42	20 25 1	25 3 52		87.308	48.287	109.260	76 23 39	12.518	54.929	45
40	0 17 11	1 8 45	2 34 40	4 34 53	7 9 12	10 17 15	13 58 20	18 11 18	22 54 15	28 4 18		89.382	51.148	106.076	85 56 37	13.850	53.100	40
35																		35
33																		33
30																		30
25																		25
23																		23
20																		20
15																		15
14																		14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=120 metre

R_C	Length of Transition Curve to Chord Points in Metre																								R_C
	12.0		24.0		36.0		48.0		60.0		72.0		84.0		96.0		108.0		120.0						
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10					meter
2500	12.000	0.001	24.000	0 008	36.000	0.026	48.000	0.061	60.000	0.120	71.999	0.207	83.999	0.329	95.998	0.492	107.996	0.700	119.993	0.960					**2500**
2200	12.000	0.001	24.000	0 009	36.000	0.029	48.000	0.070	60.000	0.136	71 999	0.236	83.999	0.374	95.997	0.559	107.995	0.795	119.991	1.091					**2200**
2000	12.000	0.001	24 000	0.010	36.000	0.032	48.000	0.077	60.000	0.150	71.999	0.259	83.998	0 412	95.996	0.614	107.994	0.875	119.989	1.200					**2000**
1800	12.000	0 001	24.000	0.011	36.000	0.036	48 000	0.085	60.000	0.167	71.999	0.288	83.998	0.457	95.996	0.683	107.992	0.972	119.987	1.333					**1800**
1500	12.000	0.002	34.000	0.013	36.000	0.043	48.000	0.102	59 999	0.200	71.999	0.346	83.997	0.549	95.994	0.819	107.989	1.166	119.981	1.600					**1500**
1200	12.000	0.002	24.000	0 016	36.000	0.054	48.000	0.128	59.999	0.250	71.998	0.432	83.995	0.686	95 990	1.024	107.982	1.458	119.970	2.000					**1200**
1000	12.000	0.002	24.000	0.019	36.000	0.065	48.000	0.154	59.999	0.300	71.997	0 518	83.993	0.823	95.986	1.229	107.974	1.749	119.957	2.399					**1000**
900	12.000	0.003	24.000	0.021	36.000	0.072	47.999	0.171	59.998	0.333	71 996	0.576	83.991	0.915	95.983	1.365	107.969	1.944	119.947	2.666					**900**
800	12.000	0.003	24.000	0.024	36.000	0.081	47.999	0.192	59.998	0.375	71.995	0.648	83.989	1.029	95.978	1.536	107.960	2.186	119.933	2.999					**800**
700	12.000	0.003	24.000	0.027	36.000	0.093	47 999	0.219	59 997	0.429	71.993	0.741	83.985	1.176	95.971	1.755	107.948	2.499	119.912	3.427					**700**
600	12.000	0.004	24.000	0.032	36 000	0.108	47 999	0.256	59.996	0.500	71.991	0 864	83.980	1.372	95.961	2.047	107.929	2.915	119.880	3.997					**600**
500	12.000	0.005	24.000	0.038	36.000	0 130	47.998	0.307	59.995	0.600	71.987	1.037	83.971	1.646	95.943	2.457	107.898	3.497	119.827	4.795					**500**
400	12.000	0.006	24.000	0.048	35.999	0.162	47.997	0.384	59.992	0.750	71.979	1.296	83.955	2.057	95.912	3.070	107.841	4.369	119.730	5.990					**400**
360	12.000	0.007	24.000	0.053	35.999	0.180	47.997	0.427	59 990	0.833	71.974	1.440	83.944	2.286	95.891	3.411	107.803	4.854	119.667	6.653					**360**
350	12 000	0.007	24.000	0.055	35.999	0.185	47.996	0.439	59.989	0.857	71.973	1.481	83.941	2.351	95.885	3.508	107.792	4 992	119 648	6.843					**350**
300	12.000	0.008	24 000	0.064	35.999	0.216	47.995	0.512	59.985	1.000	71.963	1.727	83.919	2.742	95.843	4.091	107.717	5.821	119.521	7.977					**300**
250	12.000	0.010	24.000	0.077	35.998	0.259	47.993	0.614	59.978	1.200	71.946	2.072	83.884	3 290	95.774	4.907	107.593	6.980	119.311	9.561					**250**
230	12.000	0 010	24.000	0.083	35.998	0.282	47.992	0.668	59.974	1.304	71.937	2.252	83.863	3.575	95.733	5.332	107.519	7.583	119.186	10.384					**230**
200	12.000	0 012	24.000	0 096	35.997	0.324	47.989	0.768	59.966	1.499	71.916	2.590	83.819	4.110	95.647	6.128	107.364	8.711	118 924	11 923					**200**
170	12.000	0.014	24.000	0.113	35.996	0.381	47.985	0.903	59.953	1 764	71.884	3 046	83.749	4.832	95.511	7.202	107.121	10.232	118.514	13 993					**170**
155	12.000	0.015	23.999	0.124	35.996	0.418	47.982	0.991	59.944	1.934	71.860	3.340	83.698	5.297	95.412	7.893	106.943	11.209	118.214	15.319					**155**
125	12.000	0.019	23.999	0.154	35.993	0.518	47.972	1.228	59.914	2.398	71.785	4 138	83.537	6.560	95.098	9.764	106.379	13.846	117.265	18.886					**125**
100	12.000	0.024	23.999	0.192	35.990	0.648	47.956	1.535	59.865	2 995	71.665	5.167	83.277	8.181	94.594	12.159	105.477	17.203	115.751	23.390					**100**
90	12.000	0.027	23.998	0.213	35 987	0.720	47.945	1.705	59.834	3.327	71.586	5.736	83.108	9.077	94.267	13.477	104.893	19.039	114.775	25.832					**90**
80	12.000	0.030	33 998	0.240	35.984	0.810	47.931	1.918	59.789	3.741	71.477	6.446	82.873	10.191	93 812	15.109	104.082	21.300	113.423	28.816					**80**
70	12.000	0.034	23.997	0.274	35 979	0.925	47.910	2.191	59.725	4 272	71.317	7 355	82.530	11.613	93.151	17.181	102.909	24.147	111.478	32.528					**70**
60	12.000	0.040	23.996	0 320	35 971	1 079	47.877	2.555	59.626	4.978	71.072	8.560	82.005	13.486	92.142	19.889	101.126	27.822	108.543	37.232					**60**
55	12.000	0.044	23.995	0.349	35.965	1.177	47.854	2.787	59.555	5.426	70.897	9.322	81.631	14.665	91.425	21.576	99 867	30.080	106.484	40.065					**55**
50	12.000	0.048	23.994	0.384	35.958	1.295	47.823	3.064	59.462	5.962	70.668	10.231	81.142	16.062	90.490	23.560	98.233	32.700	103.834	43 283					**50**
45	12.000	0.053	23.993	0.427	35.948	1.439	47.782	3 402	59.337	6.614	70.359	11.332	80.485	17.743	89 241	25.919	96.065	35.759	100.350	46.932					**45**
40	12.000	0.060	23.991	0.480	35.934	1.618	47.724	3.824	59.162	7.425	69.929	12.693	79.574	19.799	87.522	28.756	93.109	39.339	95.666	51.020					**40**
35																									**35**
33																									**33**
30																									**30**
25																									**25**
23																									**23**
20																									**20**
15																									**15**
14																									**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 125 metre

R_C	Length of Transition Curve to Chord Points in Metre										L. T.	S. T	L. C.	Θ_s	s	K	R_C
	12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	112.5	125.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 17	0 1 8	0 2 34	0 4 35	0 7 9	0 10 18	0 14 2	0 18 20	0 23 12	0 28 38	83.336	41.669	124.997	1 25 56	0.260	62.499	2500
2200	0 0 19	0 1 18	0 2 55	0 5 12	0 8 8	0 11 43	0 15 57	0 20 50	0 26 22	0 32 33	83.337	41.670	124.996	1 37 39	0.296	62.498	2200
2000	0 0 21	0 1 25	0 3 13	0 5 43	0 8 57	0 12 53	0 17 32	0 22 55	0 29 0	0 35 48	83.338	41.671	124.995	1 47 25	0.325	62.498	2000
1800	0 0 23	0 1 35	0 3 34	0 6 21	0 9 56	0 14 19	0 19 29	0 25 27	0 32 13	0 39 47	83.339	41.671	124.993	1 59 21	0.362	62.497	1800
1500	0 0 28	0 1 54	0 4 17	0 7 38	0 11 56	0 17 11	0 23 23	0 30 33	0 38 40	0 47 44	83.341	41.674	124.990	2 23 14	0.434	62.496	1500
1200	0 0 35	0 2 23	0 5 22	0 9 32	0 14 55	0 21 29	0 29 14	0 38 11	0 48 20	0 59 40	83.345	41.677	124.985	2 59 2	0.542	62.494	1200
1000	0 0 42	0 2 51	0 6 26	0 11 27	0 17 54	0 25 46	0 35 5	0 45 50	0 58 0	1 11 37	83.350	41.682	124.978	3 34 51	0.651	62.492	1000
900	0 0 47	0 3 10	0 7 9	0 12 43	0 19 53	0 28 38	0 38 59	0 50 55	1 4 27	1 19 34	83.354	41.686	124.973	3 58 43	0.723	62.490	900
800	0 0 53	0 3 34	0 8 3	0 14 19	0 22 22	0 32 13	0 43 51	0 57 17	1 12 30	1 29 31	83.360	41.691	124.966	4 28 34	0.814	62.487	800
700	0 1 1	0 4 5	0 9 12	0 16 22	0 25 34	0 36 49	0 50 7	1 5 28	1 22 52	1 42 18	83.368	41.698	124.956	5 6 56	0.930	62.483	700
600	0 1 11	0 4 46	0 10 44	0 19 5	0 29 50	0 42 58	0 58 29	1 16 23	1 36 40	1 59 21	83.381	41.710	174.940	5 58 5	1.085	62.477	600
500	0 1 25	0 5 43	0 12 53	0 22 55	0 35 48	0 51 33	1 10 11	1 31 40	1 56 0	2 23 13	83.401	41.729	124.913	7 9 43	1.301	62.467	500
400	0 1 47	0 7 9	0 16 6	0 28 38	0 44 45	1 4 27	1 27 43	1 54 34	2 25 0	2 59 0	83.440	41.764	124.864	8 57 8	1.626	62.449	400
360	0 1 59	0 7 57	0 17 54	0 31 49	0 49 44	1 11 37	1 37 28	2 7 18	2 41 7	3 18 53	83.465	41.787	124.832	9 56 49	1.807	62.437	360
350	0 2 2	0 8 11	0 18 24	0 32 44	0 51 9	1 13 39	1 40 15	2 10 56	2 45 43	3 24 34	83.472	41.794	124.822	10 13 53	1.858	62.433	350
300	0 2 23	0 9 32	0 21 29	0 38 11	0 59 40	1 25 56	1 56 58	2 32 45	3 13 19	3 58 38	83.522	41.840	124.758	11 56 11	2.167	62.409	300
250	0 2 51	0 11 27	0 25 46	0 45 50	1 11 37	1 43 7	2 20 21	3 3 18	3 51 58	4 46 19	83.606	41.916	124.651	14 19 26	2.598	62.368	250
230	0 3 6	0 12 27	0 28 1	0 49 49	1 17 50	1 52 5	2 32 33	3 19 14	4 12 7	5 11 11	83.655	41.962	124.587	15 34 10	2.823	62.343	230
200	0 3 34	0 14 19	0 32 13	0 57 17	1 29 31	2 8 54	2 55 26	3 49 6	4 49 54	5 57 48	83.758	42.058	124.453	17 54 17	3.244	62.292	200
170	0 4 12	0 16 51	0 37 54	1 7 24	1 45 18	2 31 38	3 26 22	4 29 30	5 40 59	7 0 48	83.921	42.211	124.240	21 3 52	3.811	62.209	170
155	0 4 37	0 18 28	0 41 35	1 13 55	1 55 30	2 46 18	3 46 20	4 55 33	6 13 55	7 41 25	84.039	42.323	124.084	23 6 11	4.176	62.148	155
125	0 5 43	0 22 55	0 51 33	1 31 40	2 23 13	3 26 12	4 40 36	6 6 22	7 43 26	9 31 44	84.415	42.685	123.581	28 38 52	5.162	61.947	125
100	0 7 9	0 28 38	1 4 27	1 54 34	2 59 0	4 17 43	5 50 39	7 37 44	9 38 51	11 53 48	85.017	43.282	122.758	35 48 35	6.420	61.607	100
90	0 7 57	0 31 49	1 11 37	2 7 18	3 18 53	4 46 19	6 29 32	8 28 26	10 42 50	13 12 29	85.407	43.680	122.212	39 47 19	7.110	61.376	90
80	0 8 57	0 35 48	1 20 34	2 23 13	3 43 44	5 22 4	7 18 7	9 31 44	12 2 40	14 50 33	85.951	44.251	121.436	44 45 44	7.963	61.037	80
70	0 10 13	0 40 55	1 32 4	2 43 40	4 15 40	6 8 0	8 20 31	10 52 59	13 45 1	16 56 5	86.741	45.113	120.282	51 9 25	9.040	60.514	70
60	0 11 56	0 47 44	1 47 25	3 10 56	4 58 14	7 9 12	9 43 35	12 41 2	16 0 56	19 42 24	87.957	46.514	118.450	59 40 59	10.440	59.642	60
55	0 13 1	0 52 5	1 57 11	3 28 17	5 25 19	7 48 7	10 36 22	13 49 36	17 27 2	21 27 29	88.834	47.576	117.101	65 6 32	11.306	58.967	55
50	0 14 19	0 57 17	2 8 54	3 49 6	5 57 48	8 34 46	11 39 37	15 11 41	19 9 55	23 32 42	90.001	49.054	115.285	71 37 11	12.318	58.020	50
45	0 15 54	1 3 39	2 23 13	4 14 32	6 37 28	9 31 44	12 56 46	16 51 38	21 14 54	26 4 18	91.622	51.215	112.762	79 34 39	13.510	56.630	45
40	0 17 54	1 11 37	2 41 7	4 46 19	7 27 2	10 42 50	14 32 55	18 55 58	23 49 51	29 11 14	94.029	54.597	109.122	89 31 28	14.927	54.484	40
35																	35
33																	33
30																	30
25																	25
23																	23
20																	20
15																	15
14																	14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=125 metre

R_C	Length of Transition Curve to Chord Points in Metre														R_C						
	12.5		25.0		37.5		50.0		62.5		75.0		87.5		100.0		112.5		125.0		
metre	X 1	Y 1	X 2	Y 2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	12.500	0.001	25.000	0.008	37.500	0.028	50.000	0.067	62.500	0.130	74.999	0.225	87.499	0.357	99.997	0.533	112.495	0.759	124.992	1.042	**2500**
2200	12.500	0.001	25.000	0.009	37.500	0.032	50.000	0.076	62.500	0.148	74.999	0.256	87.498	0.406	99.997	0.606	112.494	0.863	124.990	1.184	**2200**
2000	12.500	0.001	25.000	0.010	37.500	0.035	50.000	0.083	62.500	0.163	74.999	0.281	87.498	0.447	99.996	0.667	112.493	0.949	124.988	1.302	**2000**
1800	12.500	0.001	25.000	0.012	37.500	0.039	50.000	0.093	62.500	0 181	74.999	0.312	87.497	0.496	99.995	0.741	112.491	1.055	124.985	1.447	**1800**
1500	12.500	0.002	25.000	0.014	37.500	0.047	50.000	0.111	62.499	0.217	74.998	0.375	87.496	0.595	99.993	0.889	112.487	1.266	124.978	1.736	**1500**
1200	12.500	0.002	25.000	0.017	37.500	0.059	50.000	0.139	62.499	0.271	74.997	0.469	87.494	0 744	99.989	1.111	112.480	1.582	124.966	2.170	**1200**
1000	12.500	0.003	25.000	0.021	37.500	0.070	49.999	0.167	62.498	0.326	74.996	0.562	87.492	0.893	99.984	1.333	112.471	1.898	124.951	2.603	**1000**
900	12.500	0.003	25.000	0.023	37.500	0.078	49.999	0.185	62.498	0.362	74.995	0.625	87.490	0.992	99.980	1.481	112.464	2.109	124.940	2.893	**900**
800	12.500	0.003	25.000	0.026	37.500	0.088	49.999	0.208	62.498	0.407	74.994	0.703	87.487	1.116	99.975	1.666	112.455	2.372	124.924	3.254	**800**
700	12.500	0.004	25 000	0.030	37.500	0.100	49.999	0.238	62.497	0.465	74.992	0.804	87.483	1.276	99.967	1.904	112.441	2.711	124.900	3.718	**700**
600	12.500	0.004	25.000	0.035	37.500	0.117	49.499	0.278	62.496	0.543	74.989	0.937	87.477	1.488	99.956	2.222	112.420	3.162	124.864	4.337	**600**
500	12.500	0.005	25.000	0 042	37.500	0.141	49 998	0.333	62.494	0.651	74.985	1.125	87.467	1.786	99.936	2.665	112.385	3.794	124.805	5.203	**500**
400	12.500	0.007	25 000	0.052	37.499	0.176	49.997	0 417	62.490	0.814	74.976	1.406	87.449	2.232	99.900	3.331	112.320	4.741	124.695	6.499	**400**
360	12.500	0.007	25.000	0.058	37.499	0.195	49.996	0.463	62.488	0.904	74.971	1.562	87.437	2.480	99.877	3.700	112.278	5.266	124.624	7.218	**360**
350	12.500	0.007	25.000	0.060	37.499	0.201	49.996	0.476	62.488	0.930	74.969	1.607	87.433	2.551	99.869	3.806	112.265	5.416	124.602	7.424	**350**
300	12.500	0.009	25.000	0 069	37.499	0.234	49.994	0.556	62.483	1.085	74.958	1.874	87.409	2.975	99.822	4.439	112 180	6.315	124.459	8.654	**300**
250	12.500	0.010	25 000	0.083	37.498	0.281	49.992	0.667	62.476	1.302	74.939	2.249	87.369	3.569	99.744	5.324	112.040	7.572	124.221	10.370	**250**
230	12.500	0.011	25.000	0.091	37.498	0.306	49.991	0.725	62.471	1.415	74.928	2.444	87.345	3.879	99.698	5.785	111.956	8.226	124.080	11.263	**230**
200	12.500	0.013	25 000	0.104	37.497	0.352	49.988	0.833	62.462	1.627	74.905	2 810	87.295	4 459	99.601	6.648	111.781	9.449	123.785	12.930	**200**
170	12.500	0 015	24.999	0.123	37.496	0.414	49.983	0.980	62.447	1.914	74.869	3.305	87.216	5.242	99.448	7.812	111.506	11.097	123.321	15.171	**170**
155	12.500	0.017	24.999	0.134	37.495	0.454	49.979	1.075	62 437	2.099	74.842	3.624	87.159	5.747	99.336	8.561	111.306	12.155	122.983	16.607	**155**
125	12.500	0.021	24.999	0 167	37.492	0.562	49 968	1.333	62.402	2.601	74.757	4.490	86.976	7.115	98.981	10.589	110.669	15.010	121.911	20.464	**125**
100	12.500	0.026	24.998	0.208	37.488	0.703	49.950	1.665	62.348	3.250	74.621	5.605	86.683	8.873	98.412	13.182	109.651	18.640	120.205	25.324	**100**
90	12.500	0.029	24.998	0.231	37.485	0.781	49.938	1.850	62.312	3.609	74.533	6.222	86.492	9.843	98.043	14.607	108.992	20.622	119.605	27.954	**90**
80	12.500	0.033	24.998	0.260	37.481	0.879	49.922	2.081	62.262	4.058	74.409	6.992	86.226	11.049	97.529	16.371	108.078	23.060	117.583	31.160	**80**
70	12.500	0.037	24.997	0.298	37.476	1.004	49.898	2.377	62.189	4.634	74.229	7.977	85.840	12.587	96.784	18.608	106.757	26.124	115.396	35.137	**70**
60	12.500	0.043	24.996	0.347	37.467	1.171	49.861	2.772	62.077	5.399	73.952	9.281	85.248	14.612	95.646	21.527	104.751	30.068	112.101	40.153	**60**
55	12.500	0.047	24.995	0.379	37.461	1.277	49.835	3.023	61.997	5.885	73.755	10.106	84.826	15.884	94.839	23.342	103.335	32.484	109.795	43.157	**55**
50	12.500	0.052	24.994	0.417	37.453	1.405	49.800	3.324	61.892	6.465	73.495	11.088	84.274	17.392	93.787	25.472	101.501	35.278	106.831	46.552	**50**
45	12.500	0.058	24.992	0.463	37.441	1.561	49.754	3.691	61.751	7.172	73.147	12.279	83.533	19.202	92.383	27.999	99.072	38.524	102.945	50.370	**45**
40	12.500	0.065	24.990	0.521	37.426	1.755	49.688	4.148	61.553	8.050	72.661	13.748	82.508	21.413	90.452	31.027	95.767	42.300	97.737	54.595	**40**
35																					**35**
33																					**33**
30																					**30**
25																					**25**
23																					**23**
20																					**20**
15																					**15**
14																					**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

R_D	Length of Transition Curve to Chord Points in Metre											L.T.	S.T.	L.C.	Θ_s	s	K	R_C
	13.0	26.0	39.0	52.0	65.0	78.0	91.0	104.0	117.0	130.0								
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10								
metre	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″		metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 17	0 1 11	0 2 40	0 4 46	0 7 26	0 10 43	0 14 35	0 19 4	0 24 7	0 29 47		86.670	43.336	129.996	1 29 22	0.282	64.999	**2500**
2200	0 0 20	0 1 21	0 3 2	0 5 25	0 8 27	0 12 11	0 16 35	0 21 40	0 27 25	0 33 51		86.671	43.337	129.995	1 41 34	0.320	64.998	**2200**
2000	0 0 22	0 1 29	0 3 21	0 5 57	0 9 18	0 13 24	0 18 14	0 23 50	0 30 9	0 37 14		86.671	43.338	129.994	1 51 43	0.352	64.998	**2000**
1800	0 0 24	0 1 39	0 3 43	0 6 37	0 10 20	0 14 53	0 20 16	0 26 28	0 33 31	0 41 22		86.673	43.339	129.992	2 4 8	0.391	64.997	**1800**
1500	0 0 29	0 1 59	0 4 28	0 7 56	0 12 24	0 17 52	0 24 19	0 31 46	0 40 13	0 49 39		86.675	43.341	129.989	2 28 58	0.469	64.996	**1500**
1200	0 0 37	0 2 28	0 5 35	0 9 55	0 15 31	0 22 20	0 30 24	0 39 43	0 50 16	1 2 4		86.680	43.345	129.983	3 6 12	0.587	64.994	**1200**
1000	0 0 44	0 2 58	0 6 42	0 11 55	0 18 37	0 26 48	0 36 29	0 47 40	1 0 19	1 14 28		86.686	43.351	129.976	3 43 27	0.704	64.991	**1000**
900	0 0 49	0 3 18	0 7 26	0 13 14	0 20 41	0 29 47	0 40 33	0 52 57	1 7 2	1 22 45		86.690	43.355	129.970	4 8 16	0.782	64.989	**900**
800	0 0 55	0 3 43	0 8 22	0 14 53	0 23 16	0 33 31	0 45 37	0 59 35	1 15 24	1 33 6		86.697	43.361	129.962	4 39 19	0.880	64.986	**800**
700	0 1 3	0 4 15	0 9 34	0 17 1	0 26 36	0 38 18	0 52 8	1 8 5	1 26 11	1 46 23		86.706	43.369	129.950	5 19 13	1.006	64.981	**700**
600	0 1 14	0 4 57	0 11 10	0 19 51	0 31 2	0 44 41	1 0 49	1 19 26	1 40 32	2 4 7		86.720	43.382	129.932	6 12 25	1.173	64.974	**600**
500	0 1 29	0 5 57	0 13 24	0 23 50	0 37 14	0 53 37	1 12 59	1 35 20	2 0 39	2 28 56		86.743	43.403	129.902	7 26 54	1.407	64.963	**500**
400	0 1 51	0 7 26	0 16 45	0 29 47	0 46 33	1 7 2	1 31 14	1 59 9	2 30 48	3 6 10		86.786	43.443	129.847	9 18 38	1.759	64.942	**400**
360	0 2 4	0 8 16	0 18 37	0 33 6	0 51 43	1 14 28	1 41 22	2 12 24	2 47 33	3 26 50		86.814	43.468	129.811	10 20 42	1.954	64.929	**360**
350	0 2 7	0 8 30	0 19 9	0 34 2	0 53 12	1 16 36	1 44 16	2 16 11	2 52 20	3 32 45		86 823	43.476	129.800	10 38 26	2.009	64.925	**350**
300	0 2 28	0 9 55	0 22 20	0 39 43	1 2 4	1 29 22	2 1 38	2 38 52	3 21 3	4 8 10		86.879	43.528	129.728	12 24 50	2.343	64.897	**300**
250	0 2 58	0 11 55	0 26 48	0 47 40	1 14 28	1 47 14	2 25 58	3 10 38	4 1 14	4 57 46		86.973	43.614	129.607	14 53 48	2.810	64.851	**250**
230	0 3 14	0 12 57	0 29 8	0 51 48	1 20 57	1 56 34	2 38 39	3 27 12	4 22 11	5 23 37		87.028	43.666	129.535	16 11 32	3.053	64.824	**230**
200	0 3 43	0 14 53	0 33 31	0 59 35	1 33 6	2 14 3	3 2 26	3 58 15	5 1 29	6 12 5		87.144	43.774	129.384	18 37 16	3.508	64.765	**200**
170	0 4 22	0 17 31	0 39 25	1 10 6	1 49 31	2 37 42	3 34 37	4 40 16	5 54 36	7 17 36		87.327	43.946	129.145	21 54 26	4.121	64.672	**170**
155	0 4 48	0 19 13	0 43 14	1 16 53	2 0 7	2 52 57	3 55 22	5 7 21	6 28 51	7 59 49		87.460	44.072	128.968	24 1 38	4.515	64.602	**155**
125	0 5 57	0 23 50	0 53 37	1 35 20	2 28 56	3 34 27	4 51 49	6 21 0	8 1 55	9 54 30		87.883	44.481	128.401	29 47 37	5.579	64.375	**125**
100	0 7 26	0 29 47	1 7 2	1 59 9	3 6 10	4 28 1	6 4 39	7 55 59	10 1 53	12 22 9		88.559	45.156	127.471	37 14 32	6.936	63.989	**100**
90	0 8 16	0 33 6	1 14 28	2 12 24	3 26 50	4 57 46	6 45 5	8 48 42	11 8 24	13 43 54		88.998	45.608	126.854	41 22 49	7.680	63.724	**90**
80	0 9 18	0 37 14	1 23 47	2 28 56	3 52 40	5 34 56	7 35 36	9 54 30	12 31 21	15 25 46		89 608	46.256	125.977	46 33 10	8.597	63.337	**80**
70	0 10 38	0 42 33	1 35 45	2 50 13	4 25 53	6 22 41	8 40 28	11 18 56	14 17 42	17 36 8		90.496	47.238	124.668	53 12 11	9.755	62.737	**70**
60	0 12 24	0 49 39	1 51 43	3 18 34	5 10 9	7 26 19	10 6 49	13 11 13	16 38 51	20 28 43		91.866	48.842	122.589	62 4 13	11.256	61.732	**60**
55	0 13 32	0 54 10	2 1 52	3 36 37	5 38 18	8 6 47	11 1 41	14 22 28	18 8 15	22 17 41		92.856	50.064	121.057	67 42 47	12.183	60.952	**55**
50	0 14 53	0 59 35	2 14 3	3 58 15	6 12 5	8 55 17	12 7 24	15 47 43	19 55 0	24 27 29		94.180	51.775	118.993	74 29 4	13.263	59.852	**50**
45	0 16 33	1 6 12	2 28 56	4 24 42	6 53 20	9 54 30	13 27 34	17 31 30	22 4 39	27 4 27		96.035	54.294	116.123	82 45 38	14.532	58.235	**45**
40																		**40**
35																		**35**
33																		**33**
30																		**30**
25																		**25**
23																		**23**
20																		**20**
15																		**15**
14																		**14**

Ls = 130 metre

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=130 metre

R_C	Length of Transition Curve to Chord Points in Metre																				R_C
	13.0		26.0		39.0		52.0		65.0		78.0		91.0		104.0		117.0		130.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	13.000	0.001	26.000	0.009	39.000	0.030	52.000	0.072	65.000	0.141	77.999	0.243	90.999	0.386	103.997	0.577	116.995	0.821	129.991	1.127	**2500**
2200	13.000	0.001	26.000	0.010	39.000	0 035	52.000	0.082	65.000	0.160	77.999	0.277	90.998	0.439	103.996	0.655	116.993	0.933	129.989	1.280	**2200**
2000	13.000	0.001	26.000	0.011	39.000	0.038	52.000	0.090	65.000	0.176	77.999	0.304	90.998	0.483	103.995	0.721	116.992	1.027	129.986	1.408	**2000**
1800	13.000	0.002	26.000	0.013	39.000	0.042	52.000	0.100	64.999	0.196	77.999	0.338	90.997	0.537	103.994	0.801	116.990	1.141	129.983	1.565	**1800**
1500	13.000	0.002	26.000	0.015	39.000	0.051	52.000	0.120	64.999	0.235	77.998	0.406	90.996	0.644	103.992	0.961	116.986	1.369	129.976	1.878	**1500**
1200	13.000	0.002	26.000	0 019	39.000	0 063	52.000	0.150	64.999	0.293	77.997	0.507	90.994	0.805	103.988	1.202	116.977	1.711	129.962	2.347	**1200**
1000	13.000	0.003	26.000	0.023	39.000	0.076	51.999	0.180	64.998	0.352	77.996	0.608	90.991	0.966	103.982	1.442	116.968	2.053	129.945	2.816	**1000**
900	13.000	0.003	26.000	0.025	39.000	0.084	51.999	0.200	64.998	0.391	77.995	0.676	90.989	1.073	103 978	1.602	116.960	2.281	129.932	3.128	**900**
800	13.000	0.004	26.000	0.028	39.000	0.095	51.999	0.225	64.997	0.440	77.993	0.760	90.986	1.208	103.972	1.802	116.949	2.566	129.914	3.519	**800**
700	13.000	0.004	26.000	0.032	39.000	0.109	51.999	0.258	64.996	0.503	77.991	0.869	90.981	1.380	103.963	2.060	116.934	2.932	129.888	4.021	**700**
600	13.000	0.005	26.000	0.038	39.000	0.127	51.998	0.300	64.995	0.587	77.988	1.014	90.974	1.610	103.950	2.403	116.910	3.420	129.848	4.691	**600**
500	13.000	0.006	26.000	0.045	38.999	0.152	51.998	0.361	64.993	0.704	77.983	1.217	90.963	1.932	103.928	2.883	116.870	4.103	129 780	5.627	**500**
400	13 000	0.007	26.000	0.056	38.999	0.190	51.996	0.451	64.989	0.880	77.973	1.521	90.942	2.414	103.888	3.603	116.797	5.127	129.657	7.028	**400**
360	13.000	0.008	26.000	0.063	38.999	0.211	51.996	0.501	64.987	0.978	77.967	1.689	90.929	2.682	103.861	4.002	116.750	5.695	129.577	7.806	**360**
350	13.000	0.008	26.000	0.064	38.999	0.217	51.995	0.515	64.986	1.006	77.965	1.738	90.925	2.759	103.853	4.116	116.736	5.857	129.552	8.028	**350**
300	13.000	0.009	26.000	0.075	38.999	0.253	51.994	0.601	64.981	1.173	77.953	2.027	90.897	3.218	103.800	4 801	116.640	6.829	129.391	9.357	**300**
250	13.000	0.011	26.000	0.090	38.998	0.304	51.991	0.721	64.973	1.408	77.932	2.432	90.852	3.860	103.712	5.757	116.482	8.187	129.124	11.212	**250**
230	13.000	0.012	26.000	0.098	38.997	0.331	51.989	0.784	64.968	1.530	77.919	2.643	90.826	4.195	103.660	6.256	116.388	8.894	128.966	12.177	**230**
200	13.000	0.014	26.000	0.113	38.997	0.380	51.986	0.901	64.957	1.760	77.893	3 039	90.769	4.822	103.551	7.188	116.192	10.216	128.634	13.977	**200**
170	13.000	0.017	25.999	0.133	38.995	0.447	51.981	1.060	64.941	2.070	77.852	3.574	90.681	5.669	103.379	8.447	115.883	11.996	128.112	16.396	**170**
155	13.000	0.018	25.999	0.145	38.994	0.491	51.977	1.163	64.929	2.270	77.822	3.919	90.617	6.214	103.253	9.256	115.657	13.139	127.732	17.945	**155**
125	13.000	0.023	25.999	0.180	38.991	0.608	51.964	1.441	64.890	2.813	77.727	4.855	90.411	7 693	102.854	11.446	114.941	16.220	126.529	22.102	**125**
100	13.000	0.028	25.998	0.225	38.987	0.760	51.944	1.801	64.829	3.514	77 574	6.060	90.081	9.591	102.215	14.244	113.798	20.230	124.614	27.328	**100**
90	13.000	0.031	25.998	0.250	38.984	0.845	51.931	2.001	64.788	3.903	77.474	6.727	89.867	10.639	101.800	15.781	113.059	22.263	123.381	30.149	**90**
80	13.000	0 035	25.997	0.282	38.979	0.950	51.912	2.251	64.732	4.388	77.335	7.559	89.568	11.940	101.223	17.681	112.033	24.884	121.676	33.583	**80**
70	13.000	0.040	25.996	0.322	38.973	1.086	51.885	2.571	64.651	5.010	77.133	8.622	89.134	13.599	100.387	20 088	110.552	28 169	119.229	37.827	**70**
60	13.000	0.047	25.995	0.376	38.963	1.267	51.844	2.998	64.525	5.837	76.822	10.030	88.469	15.781	99.111	23.223	108.306	32 386	115.550	43.153	**60**
55	13.000	0.051	25.994	0.410	38.956	1.382	51.814	3.269	64.435	6.362	76.600	10.920	87.995	17.149	98.206	25.168	106.724	34.960	112.979	46.325	**55**
50	13.000	0.056	25.993	0.451	38.947	1.520	51.775	3.594	64.317	6.989	76.309	11.979	87.376	18.769	97.028	27.448	104 176	37.927	109.682	49.888	**50**
45	13.0. 0	0.063	25.991	0.501	38.934	1.688	51.723	3.991	64.158	7.751	75.917	13.261	86.546	20.713	95.457	30.144	101.967	41.358	105.370	53.861	**45**
40																					**40**
35																					**35**
33																					**33**
30																					**30**
25																					**25**
23																					**23**
20																					**20**
15																					**15**
14																					**14**

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=135 metre

R_c	Length of Transition Curve to Chord Points in Metre										I.T.	S.T.	L.C.	Θ_s	s	K	R_c
	13.5	27.0	40.5	54.0	67.5	81.0	94.5	108.0	121.5	135.0							
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10							
metre	′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 18	0 1 14	0 2 47	0 4 57	0 7 44	0 11 8	0 15 9	0 19 48	0 25 3	0 30 56	90.003	45.003	134.996	1 32 49	0.304	67.498	2500
2200	0 0 21	0 1 24	0 3 9	0 5 37	0 8 47	0 12 39	0 17 13	0 22 30	0 28 28	0 35 9	90.004	45.004	134.994	1 45 28	0.345	67.498	2200
2000	0 0 23	0 1 32	0 3 28	0 6 11	0 9 40	0 13 55	0 18 57	0 24 45	0 31 19	0 38 40	90.005	45.005	134.993	1 56 1	0.380	67.497	2000
1800	0 0 25	0 1 43	0 3 52	0 6 52	0 10 44	0 15 28	0 21 3	0 27 30	0 34 48	0 42 58	90.007	45.006	134.992	2 8 54	0.422	67.497	1800
1500	0 0 30	0 2 3	0 4 38	0 8 15	0 12 53	0 18 33	0 25 16	0 33 0	0 41 46	0 51 33	90.010	45.009	134.988	2 34 41	0.506	67.495	1500
1200	0 0 38	0 2 34	0 5 48	0 10 18	0 16 6	0 23 12	0 31 35	0 41 15	0 52 12	1 4 27	90.015	45.014	134.981	3 13 22	0.633	67.493	1200
1000	0 0 46	0 3 5	0 6 57	0 12 22	0 19 20	0 27 50	0 37 54	0 49 30	1 2 39	1 17 20	90.021	45.020	134.973	3 52 2	0.759	67.490	1000
900	0 0 51	0 3 26	0 7 44	0 13 45	0 21 29	0 30 56	0 42 6	0 55 0	1 9 36	1 25 56	90.026	45.024	134.966	4 17 49	0.844	67.487	900
800	0 0 58	0 3 52	0 8 42	0 15 28	0 24 10	0 34 48	0 47 22	1 1 52	1 18 18	1 36 40	90.034	45.031	134.957	4 50 3	0.949	67.484	800
700	0 1 6	0 4 25	0 9 56	0 17 40	0 27 37	0 39 46	0 54 8	1 10 43	1 29 29	1 50 29	90.044	45.040	134.944	5 31 29	1.084	67.479	700
600	0 1 17	0 5 9	0 11 36	0 20 37	0 32 13	0 46 24	1 3 10	1 22 30	1 44 24	2 8 54	90.060	45.054	134.924	6 26 44	1.265	67.471	600
500	0 1 32	0 6 11	0 13 55	0 24 45	0 38 40	0 55 41	1 15 47	1 39 0	2 5 17	2 34 40	90.086	45.078	134.890	7 44 5	1.518	67.459	500
400	0 1 56	0 7 44	0 17 24	0 30 56	0 48 20	1 9 36	1 34 44	2 3 44	2 36 36	3 13 19	90.134	45.122	134.829	9 40 7	1.896	67.435	400
360	0 2 8	0 8 35	0 19 20	0 34 22	0 53 42	1 17 20	1 45 16	2 17 29	2 54 0	3 34 47	90.166	45.151	134.788	10 44 34	2.107	67.420	360
350	0 2 12	0 8 50	0 19 53	0 35 21	0 55 14	1 19 33	1 48 16	2 21 25	2 58 58	3 40 55	90.175	46.160	134.776	11 2 59	2.167	67.416	350
300	0 2 34	0 10 18	0 23 12	0 41 15	1 4 27	1 32 48	2 6 19	2 44 58	3 28 47	4 17 43	90.238	45.218	134.695	12 53 29	2.527	67.385	300
250	9 3 5	0 12 22	0 27 50	0 49 30	1 17 20	1 51 22	2 31 34	3 17 57	4 10 30	5 9 12	90.343	45.315	134.560	15 28 11	3.030	67.333	250
230	0 3 21	0 13 27	0 30 16	0 53 48	1 24 4	2 1 3	2 44 45	3 35 10	4 32 16	5 36 3	90.405	45.372	134.479	16 48 54	3.292	67.302	230
200	0 3 52	0 15 28	0 34 48	1 1 52	1 36 40	2 19 12	3 9 27	4 7 25	5 13 3	6 26 22	90.535	45.494	134.310	19 20 14	3.781	67.236	200
170	0 4 32	0 18 11	0 40 56	1 12 47	1 53 44	2 43 46	3 42 52	4 51 2	6 8 13	7 34 23	90.739	45.687	134.041	22 44 59	4.442	67.131	170
155	0 4 59	0 19 57	0 44 54	1 19 50	2 4 44	2 59 36	4 4 25	5 19 10	6 43 47	8 18 13	90.888	45.829	133.843	24 57 5	4.866	67.053	155
125	0 6 11	0 24 45	0 55 41	1 39 0	2 34 40	3 42 41	5 3 1	6 35 37	8 20 24	10 17 15	91.361	46.288	133.207	30 56 23	6.012	66.796	125
100	0 7 44	0 30 56	1 9 36	2 3 44	3 13 19	4 38 19	6 18 39	8 14 15	10 24 55	12 50 28	92.118	47.049	132.161	38 40 28	7.471	66.359	100
90	0 8 35	0 34 22	1 17 20	2 17 29	3 34 47	5 9 12	7 0 38	9 8 57	11 33 56	14 15 17	92 608	47.559	131.466	42 58 18	8.270	66.059	90
80	0 9 40	0 38 40	1 27 0	2 34 40	4 1 37	5 47 47	7 53 4	10 17 15	13 0 1	16 0 56	93.291	48.292	130.477	48 20 36	9.254	65.618	80
70	0 11 2	0 44 11	1 39 26	2 56 45	4 36 6	6 37 23	9 0 24	11 44 53	14 50 21	18 16 5	94.285	49.407	129.001	55 14 58	10.495	64.932	70
60	0 12 53	0 51 33	1 56 0	3 26 12	5 22 4	7 43 26	10 30 2	13 41 23	17 16 43	21 14 54	95.822	51.236	126.652	64 27 28	12.099	63.778	60
55	0 14 3	0 56 15	2 6 33	3 44 56	5 51 18	8 25 26	11 26 59	14 55 17	18 49 22	23 7 44	96 937	52.638	124.919	70 19 3	13.087	62.880	55
50	0 15 28	1 1 52	2 19 12	4 7 25	6 26 22	9 15 47	12 35 11	16 23 42	20 40 0	25 22 2	98.436	54.611	122.583	77 20 57	14.236	61.610	50
45	0 17 11	1 3 45	2 34 40	4 34 53	7 9 12	10 17 15	13 58 20	18 11 18	22 54 15	28 4 18	100.555	57.542	119.335	85 56 37	15.581	59.738	45
40																	40
35																	35
33																	33
30																	30
25																	25
23																	23
20																	20
15																	15
14																	14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

L_s = 135 metre

R_C	Length of Transition Curve to Chord Points in Metre																				R_C
	13.5		27.0		40.5		54.0		67.5		81.0		94.5		108.0		121.5		135.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	13.500	0.001	27.000	0.010	40.500	0.033	54.000	0.078	67.500	0.152	80.999	0.262	94.498	0.417	107.997	0.622	121.494	0.886	134.990	1.215	2500
2200	13.500	0.001	27.000	0.011	40.500	0.037	54.000	0.088	67.500	0.173	80.999	0.298	94.498	0.474	107.996	0.707	121.492	1.006	134.987	1.381	2200
2000	13.500	0.002	27.000	0.012	40.500	0.041	54.000	0.097	67.500	0.190	80.999	0.328	94.497	0.521	107.995	0.778	121.491	1.107	134.985	1.519	2000
1800	13.500	0.002	27.000	0.013	40.500	0.046	54.000	0.108	67.499	0 211	80.999	0.364	94.497	0.579	107.994	0.864	121.489	1.230	134.981	1.687	1800
1500	13.500	0.002	27.000	0.016	40.500	0.055	54.000	0.130	67.499	0.253	80.998	0.437	94.495	0.695	107.991	1.037	121.484	1.476	134.973	2.025	1500
1200	13.500	0.003	27.000	0.020	40.500	0.068	54.000	0.162	67.499	0.316	80.997	0.547	94.493	0.868	107.986	1.296	121.475	1.845	134.957	2.531	1200
1000	13.500	0.003	27.000	0.024	40.500	0.082	53.999	0.194	67.498	0.380	80.995	0.656	94.490	1.042	107.980	1.555	121.464	2.214	134.939	3.037	1000
900	13.500	0.003	27.000	0.027	40.500	0.091	53.999	0.216	67.498	0.422	80.994	0.729	94.487	1.158	107.975	1.728	121.455	2.460	134.924	3.374	900
800	13.500	0.004	27.000	0.030	40.500	0.103	53.999	0.243	67.497	0.475	80.993	0.820	94.484	1.302	107.969	1.944	121.443	2.767	134.904	3.795	800
700	13.500	0.004	27.000	0.035	40.501	0.117	53.999	0.278	67.496	0.542	80.990	0.937	94.479	1.488	107.959	2.221	121.426	3.162	134.875	4.336	700
600	13.500	0.005	27.000	0.040	40.500	0.137	53.998	0.324	67.495	0.633	80.987	1.093	94.471	1.736	107.944	2.591	121.399	3.688	134.829	5.058	600
500	13.500	0.006	27.000	0.049	40.499	0 164	53.997	0.389	67.492	0.759	80.981	1.312	94.459	2.083	107.919	3.109	121.355	4.425	134.754	6.067	500
400	13.500	0.008	27.000	0.061	40.499	0.205	53.996	0.486	67.488	0.949	80.970	1.640	94.435	2.603	107.874	3.885	121.273	5.528	134.616	7.578	400
360	13.500	0.008	27.000	0.067	40.499	0.228	53.995	0.540	67.485	1.055	80.963	1.822	94.420	2.892	107.845	4.316	121.220	6.141	134.526	8.416	360
350	13.500	0.009	27.000	0.069	40.499	0.234	53.995	0.555	67.484	1.085	80.961	1.874	94.416	2.975	107.836	4.439	121.204	6.316	134.499	8.656	350
300	13.500	0.010	27.000	0.081	40.498	0.273	53.993	0.648	67.479	1.265	80.947	2.186	94.385	3.470	107.776	5.176	121.097	7.364	134.318	10.088	300
250	13.500	0.012	27.000	0.097	40.498	0.328	53.990	0.777	67.469	1.518	80.924	2.623	94.335	4.162	107.678	6.208	120.920	8.827	134.019	12.087	250
230	13.500	0.013	27.000	0.106	40.497	0.357	53.988	0.845	67.464	1.650	80.910	2.850	94.305	4.523	107.620	6.745	120.815	9.589	133.842	13.125	230
200	13.500	0.015	27.000	0.121	40.496	0.410	53.984	0.972	67.452	1.897	80.881	3.277	94.242	5.199	107.497	7.750	120.595	11.013	133.470	15.064	200
170	13.500	0.018	26.999	0.143	40.495	0.482	53.978	1.143	67.434	2.232	80.835	3.854	94.143	6.112	107.305	9.106	120.249	12.930	132.887	17.667	170
155	13.500	0.020	26.999	0.157	40.494	0.529	53.974	1.254	67.420	2.448	80.801	4.225	94.071	6.700	107.164	9.978	119.997	14.160	132.462	19.333	155
125	13.500	0.024	26.999	0.194	40.490	0.656	53.960	1.554	67.377	3.034	80.694	5.235	93.841	8.293	106.717	12.336	119.196	17.474	131.116	23.799	125
100	13.500	0.030	26.998	0.243	40.485	0.820	53.937	1.942	67.308	3.789	80.523	6.533	93.471	10.337	106.002	15.346	117.918	21.675	128.977	29.401	100
90	13.500	0.034	26.998	0 270	40.482	0.911	53.922	2.158	67.263	4.208	80.411	7.252	93.232	11.465	105.538	16.998	117.092	23.963	127.601	32.418	90
80	13.500	0.038	26.997	0.304	40.477	1.025	53.902	2.427	67.200	4.731	80.256	8.147	92.897	12.865	104.893	19.039	115.946	26.769	125.701	36 081	80
70	13.500	0.043	26 996	0.347	40.470	1.171	53 872	2.772	67.109	5.402	80.029	9.292	92.412	14.648	103.959	21.620	114.294	30.281	122.976	40.595	70
60	13.500	0.051	26.995	0.405	40.458	1.366	53.825	3.233	66.968	6.292	79.681	10.808	91.668	16.991	102.534	24.976	111.791	34 774	118.886	46.229	60
55	13.500	0.055	26.993	0.442	40.451	1.490	53.792	3.525	66.867	6.857	79.433	11.764	91.139	18.459	101.525	27.055	110.030	37,507	116.035	49.563	55
50	13.500	0.061	26.992	0.486	40.440	1.639	53.749	3.875	66.735	7.532	79.108	12.902	90.448	20.195	100.212	29.484	107.754	40.645	112.385	53.286	50
45	13.500	0.067	26.990	0.540	40.426	1.820	53.690	4.302	66.557	8.353	78.670	14.279	89.521	22.274	98.462	32.351	104.748	44.256	107.625	57.398	45
40																					40
35																					35
33																					33
30																					30
25																					25
23																					23
20																					20
15																					15
14																					14

Appendix 4

TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls = 140 metre

R_O	Length of Transition Curve to Chord Points in Metre											L.T.	S.T.	L.C.	Θ_s	s	K	R_O
	14.0	28.0	42.0	56.0	70.0	84.0	98.0	112.0	126.0	140.0								
	Alpha 1	Alpha 2	Alpha 3	Alpha 4	Alpha 5	Alpha 6	Alpha 7	Alpha 8	Alpha 9	Alpha 10								
metre	′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″		metre	metre	metre	° ′ ″	metre	metre	metre
2500	0 0 19	0 1 17	0 2 53	0 5 8	0 8 1	0 11 33	0 15 43	0 20 32	0 25 59	0 32 5		93.337	46.670	139.995	1 36 15	0.327	69.998	**2500**
2200	0 0 21	0 1 27	0 3 16	0 5 50	0 9 6	0 13 7	0 17 51	0 23 20	0 29 31	0 36 27		93.338	46.671	139.994	1 49 22	0.371	69.998	**2200**
2000	0 0 24	0 1 36	0 3 36	0 6 25	0 10 1	0 14 26	0 19 39	0 25 40	0 32 29	0 44 6		93.339	46.672	139.992	2 0 19	0.408	69 997	**2000**
1800	0 0 26	0 1 46	0 4 0	0 7 7	0 11 8	0 16 2	0 21 50	0 28 31	0 36 5	0 44 33		93.341	46.673	139.991	2 13 41	0.454	69.996	**1800**
1500	0 0 32	0 2 8	0 4 48	0 8 33	0 13 22	0 19 15	0 26 12	0 34 13	0 43 18	0 53 28		93.344	46.676	139.986	2 40 25	0.544	69.995	**1500**
1200	0 0 40	0 2 40	0 6 0	0 10 41	0 16 42	0 24 3	0 32 45	0 42 46	0 54 8	1 6 50		93.350	46.682	139.979	3 20 32	0.688	62 992	**1200**
1000	0 0 48	0 3 12	0 7 13	0 12 50	0 20 3	0 28 52	0 39 18	0 51 20	1 4 58	1 20 12		93.357	46.688	139.970	4 0 38	0.816	69.989	**1000**
900	0 0 53	0 3 33	0 8 1	0 14 15	0 22 16	0 32 5	0 43 40	0 57 2	1 12 11	1 29 7		93.363	46.694	139.962	4 27 22	0.907	69.986	**900**
800	0 1 0	0 4 0	0 9 1	0 16 2	0 25 4	0 36 5	0 49 7	1 4 10	1 21 12	1 40 15		93.371	46.701	139.952	5 0 48	1.021	69.982	**800**
700	0 1 8	0 4 35	0 10 18	0 18 20	0 28 38	0 41 15	0 56 8	1 13 20	1 32 48	1 54 34		93.382	46.711	139.938	5 43 46	1.166	69.982	**700**
600	0 1 20	0 5 20	0 12 1	0 21 23	0 33 25	0 48 7	1 5 30	1 25 33	1 48 16	2 13 40		93.400	46.727	139.915	6 41 4	1.360	69.968	**600**
500	0 1 36	0 6 25	0 14 26	0 25 40	0 40 6	0 57 45	1 18 36	1 42 40	2 9 55	2 40 24		93.429	46.754	139.878	8 1 17	1.632	69.954	**500**
400	0 2 0	0 8 1	0 18 2	0 32 5	0 50 7	1 12 11	1 38 15	2 8 19	2 42 24	3 20 29		93.483	46.803	139.809	10 1 36	2.039	69.928	**400**
360	0 2 13	0 8 54	0 20 3	0 35 39	0 55 42	1 20 12	1 49 10	2 22 35	3 0 26	3 42 44		93.518	46.835	139.764	11 8 27	2.265	69.911	**360**
350	0 2 17	0 9 10	0 20 37	0 36 40	0 57 17	1 22 30	1 52 17	2 26 39	3 5 35	3 49 6		93.529	46.845	139.750	11 27 32	2.330	69.906	**350**
300	0 2 40	0 10 41	0 24 3	0 42 46	1 6 50	1 36 15	2 11 0	2 51 5	3 36 30	4 27 15		93.599	46.910	139.660	13 22 8	2.717	69.871	**300**
250	0 3 12	0 12 50	0 28 52	0 51 20	1 20 12	1 55 29	2 37 11	3 25 17	4 19 46	5 20 38		93.716	47.018	139.509	16 2 34	3.258	69.813	**250**
230	0 3 29	0 13 57	0 31 23	0 55 48	1 27 11	2 5 32	2 50 51	3 43 7	4 42 20	5 48 28		93.785	47.082	139.419	17 26 16	3.539	69.779	**230**
200	0 4 0	0 16 2	0 36 5	1 4 10	1 40 15	2 24 21	3 16 28	4 16 34	5 24 38	6 40 39		93.930	47.218	139.230	20 3 12.	4.006	69.705	**200**
170	0 4 43	0 18 52	0 42 27	1 15 29	1 57 57	2 49 50	3 51 7	5 1 48	6 21 50	7 51 10		94.157	47.434	138.929	23 35 32	4.775	69.588	**170**
155	0 5 10	0 20 42	0 46 34	1 22 47	2 9 21	3 6 15	4 13 28	5 30 58	6 58 42	8 36 36		94.323	47.593	138.709	25 52 31	5.231	69.500	**155**
125	0 6 25	0 25 40	0 57 45	1 42 40	2 40 24	3 50 56	5 14 14	6 50 14	8 38 52	10 39 59		94.851	48.107	137.996	32 5 8	6.461	69.211	**125**
100	0 8 1	0 32 5	1 12 11	2 8 19	3 20 28	4 48 36	6 32 39	8 32 29	10 47 57	13 18 46		95.693	48.960	136.825	40 6 25	8.025	68.718	**100**
90	0 8 54	0 35 39	1 20 12	2 22 35	3 42 44	5 20 38	7 16 10	9 29 12	11 59 28	14 46 38		96.239	49.534	136.046	44 33 48	8.881	68.378	**90**
80	0 10 1	0 40 6	1 30 14	2 40 24	4 10 34	6 0 39	8 10 32	10 39 59	13 28 40	16 36 3		97.000	50.361	134.936	50 8 1	9.934	67.878	**80**
70	0 11 27	0 45 50	1 43 7	3 3 18	4 46 19	6 52 4	9 20 21	12 10 49	15 22 57	18 55 58		98.109	51.621	133.277	57 17 44	11.259	67.097	**70**
60	0 13 22	0 53 28	2 0 8	3 33 50	5 33 59	8 0 33	10 53 15	14 11 31	17 54 31	22 0 58		99.828	53.701	130.635	66 50 42	12.968	65.778	**60**
55	0 14 35	0 58 20	2 11 14	3 53 16	6 4 17	8 44 6	11 52 15	15 28 4	19 30 25	23 57 38		101·081	55.305	128.683	72 55 18	14.018	64.748	**55**
50	0 16 2	1 4 10	2 24 21	4 16 34	6 40 39	9 36 17	13 2 55	16 59 37	21 24 52	26 16 21		102.774	57.575	126.051	80 12 50	15.236	63.288	**50**
45	0 17 49	1 11 17	2 40 24	4 45 3	7 25 3	10 39 59	14 29 5	18 51 1	23 43 41	29 3 49		105.194	60.978	122.391	89 7 36	16.657	61.129	**45**
40																		**40**
35																		**35**
33																		**33**
30																		**30**
25																		**25**
23																		**23**
20																		**20**
15																		**15**
14																		**14**

Appendix 4

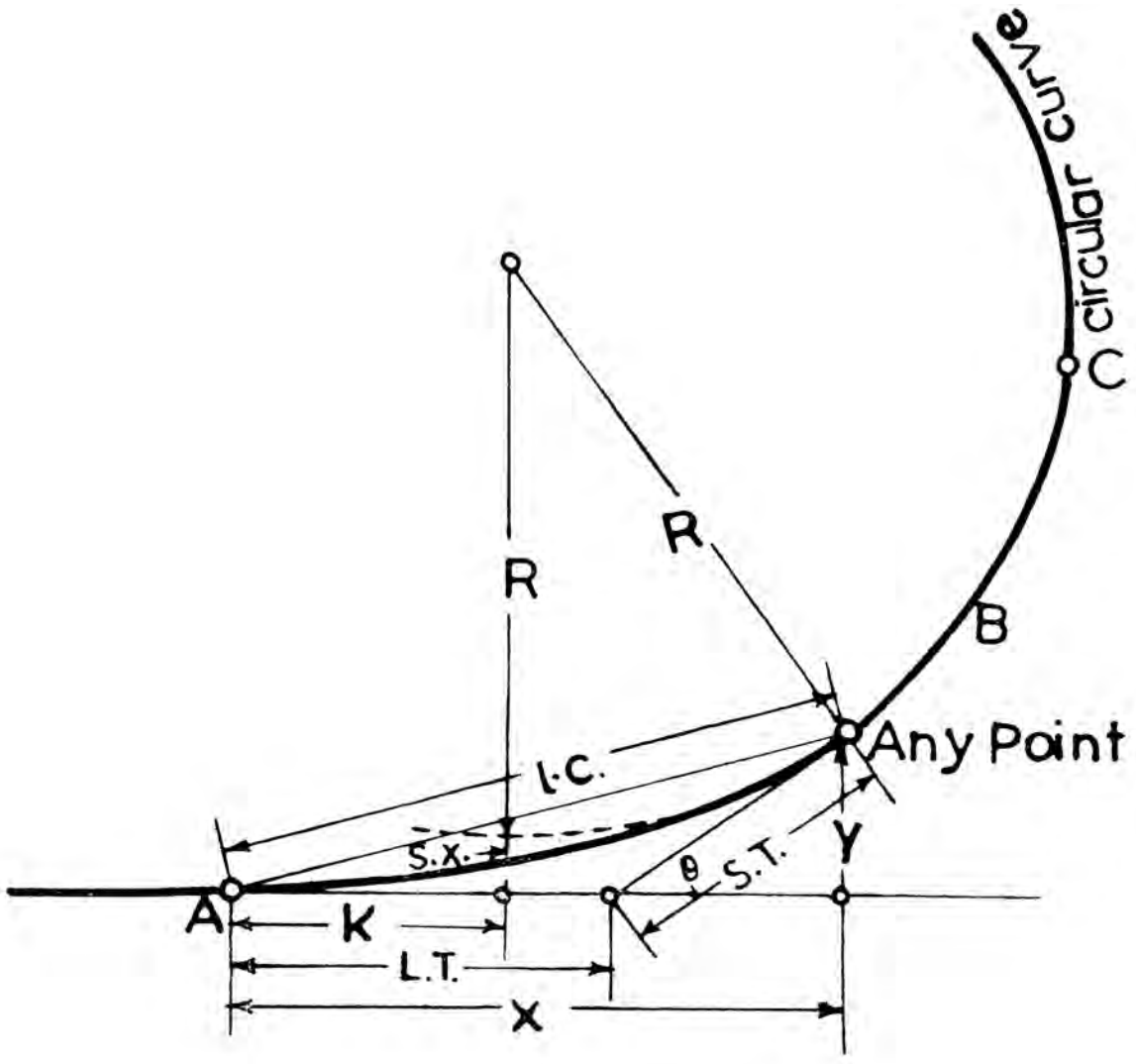
TABLE 11 : SETOUT TABLE FOR TRANSITION CURVES

Ls=140 metre

R_C	Length of Transition Curve to Chord Points in Metre																				R_C
	14.0		28.0		42.0		56.0		70.0		84.0		98.0		112.0		126.0		140.0		
metre	X 1	Y 1	X 2	Y2	X 3	Y 3	X 4	Y 4	X 5	Y 5	X 6	Y 6	X 7	Y 7	X 8	Y 8	X 9	Y 9	X 10	Y 10	metre
2500	14.000	0.001	28.000	0.010	42.000	0.035	56.000	0.084	70.000	0.163	83.999	0.282	97.998	0.448	111.996	0.669	125.994	0.953	139.989	1.307	**2500**
2200	14.000	0.001	28.000	0.012	42.000	0.040	56.000	0.095	70.000	0.186	83.999	0.321	97.998	0.509	111.995	0.760	125.992	1.082	139.986	1.485	**2200**
2000	14.000	0.002	28.000	0.013	42.000	0.044	56.000	0.105	69.999	0.204	83.999	0.353	97.997	0.560	111.994	0.836	125.990	1.191	139.983	1.633	**2000**
1800	14.000	0.002	28.000	0.015	42.000	0.049	56.000	0.116	69.999	0.227	83.998	0.392	97.996	0.622	111.993	0.929	125.988	1.323	139.979	8.815	**1800**
1500	14.000	0.002	28.000	0.017	42.000	0.059	56.000	0.139	69.999	0.272	83.998	0.470	97.995	0.747	111.990	1.115	125.982	1.587	139.970	2.177	**1500**
1200	14.000	0.003	28.000	0.022	42.000	0.073	56.000	0.174	69.999	0.340	83.996	0.588	97.992	0.934	111.984	1.394	125.972	1.984	139.952	2.722	**1200**
1000	14.000	0.003	28.000	0.026	42.000	0.088	55.999	0.209	69.998	0.408	83.995	0.706	97.988	1.120	111.978	1.672	125.960	2.381	139.931	3.266	**1000**
900	14.000	0.004	28.000	0.029	42.000	0.098	55.999	0.232	69.997	0.454	83.993	0.784	97.986	1.245	111.972	1.858	125.950	2.645	139.915	3.628	**900**
800	14.000	0.004	28.000	0.033	42.000	0.110	55.999	0.261	69.997	0.510	83.992	0.882	97.982	1.400	111.965	2.090	125.937	2.976	139.893	4.081	**800**
700	14.000	0.005	28.000	0.037	42.000	0.126	55.999	0.299	69.996	0.583	83.989	1.008	97.976	1.600	111.954	2.389	125.917	3.400	139.860	4.663	**700**
600	14.000	0.005	28.000	0.044	42.000	0.147	55.998	0.348	69.994	0.681	83.985	1.176	97.968	1.867	111.938	2.786	125.888	3.966	139.810	5.439	**600**
500	14.000	0.007	28.000	0.052	41.999	0.176	55.997	0.418	69.991	0.817	83.979	1.411	97.954	2.240	111.910	3.343	125.838	4.758	139.726	6.524	**500**
400	14.000	0.008	28.000	0.065	41.999	0.220	55.996	0.523	69.987	1.021	83.967	1.764	97.928	2.800	111.860	4.178	125.747	5.945	139.572	8.149	**400**
360	14.000	0.009	28.000	0.073	41.999	0.245	55.995	0.581	69.983	1.134	83.959	1.959	97.911	3.110	111.827	4.641	125.688	6.603	139.472	9.050	**360**
350	14.000	0.011	28.000	0.075	41.999	0.252	55.994	0.597	69.982	1.166	83.956	2.015	97.906	3.199	111.817	4.773	125.670	6.791	139.441	9.807	**350**
300	14.000	0.011	28.000	0.087	41.998	0.294	55.992	0.697	69.976	1.361	83.941	2.351	97.872	3.731	111.750	5.566	125.551	7.918	139.240	10.847	**300**
250	14.000	0.013	28.000	0.105	41.997	0.353	55.989	0.836	69.966	1.633	83.915	2.820	97.816	4.476	111.641	6.675	125.353	9.491	138.906	12.994	**250**
230	14.000	0.014	28.000	0.114	41.997	0.383	55.987	0.909	69.959	1.775	83.899	3.065	97.782	4.864	111.576	7.252	125.236	10.309	138.709	14.109	**230**
200	14.000	0.016	27.999	0.131	41.996	0.441	55.982	1.045	69.946	2.041	83.867	3.524	97.712	5.591	111.439	8.333	124.991	11.839	138.295	16.191	**200**
170	14.000	0.019	27.999	0.154	41.994	0.519	55.976	1.229	69.926	2.400	83.816	4.144	97.602	6.572	111.225	9.790	124.606	13.897	137.645	18.984	**170**
155	14.000	0.021	27.999	0.169	41.993	0.569	55.971	1.348	69.911	2.632	83.778	4.544	97.521	7.204	111.068	10.726	124.324	15.218	137.171	20.770	**155**
125	14.000	0.026	27.999	0.209	41.989	0.705	55.955	1.672	69.863	3.262	83.659	5.628	97.265	8.916	110.570	13.258	123.432	18.773	135.673	25.554	**125**
100	14.000	0.033	27.998	0.261	41.983	0.882	55.930	2.089	69.786	4.074	83.468	7.024	96.853	11.111	109.773	16.487	122.009	23.273	133.294	31.541	**100**
90	14.000	0.036	27.997	0.290	41.979	0.980	55.913	2.320	69.736	4.525	83.344	7.796	96.586	12.321	109.257	18.257	121.090	25.719	137.465	34.758	**90**
80	14.000	0.041	27.997	0.327	41.974	1.102	55.890	2.610	69.666	5.087	83.170	8.758	96.214	13.823	108.538	20.443	119.816	28.716	129.654	38.654	**80**
70	14.000	0.047	27.996	0.373	41.966	1.259	55.857	2.981	69.564	5.807	82.918	9.987	95.673	15.734	107.499	23.203	117.980	32.459	126.633	43.438	**70**
60	14.000	0.054	27.994	0.435	41.954	1.469	55.805	3.476	69.407	6.764	82.530	11.613	94.845	18.243	105.915	26.785	115.203	37.229	122.107	49.375	**60**
55	14.000	0.059	27.993	0.475	41.945	1.602	55.768	3.790	69.295	7.371	82.254	12.638	94.257	19.813	104.794	28.999	113.252	40.120	118.959	52.866	**55**
50	14.000	0.065	27.991	0.523	41.933	1.762	55.720	4.166	69.147	8.095	81.891	13.858	93.488	21.667	103.336	31.581	110.033	43.428	114.937	56.738	**50**
45	14.000	0.073	27.989	0.581	41.918	1.957	55.654	4.625	68.949	8.977	81.404	15.332	92.457	23.885	101.397	34.618	107.413	47.214	109.707	60.971	**45**
40																					**40**
35																					**35**
33																					**33**
30																					**30**
25																					**25**
23																					**23**
20																					**20**
15																					**15**
14																					**14**

Appendix 5

TABLE : 12. FUNCTIONS OF TRANSITION SPIRALS



Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

θ= 0°—4°

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
0.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	∞	**0.0**
0.1	0.0002	0.0000	0.5000	1.0000	0.0006	0.0000	0.0591	0.6667	0.3333	1.0000	286.4790	**0.1**
0.2	0.0003	0.0000	0.5000	1.0000	0.0012	0.0000	0.0836	0.6667	0.3333	1.0000	143.2395	**0.2**
0.3	0.0004	0.0000	0.5000	1.0000	0.0018	0.0000	0.1023	0.6667	0.3333	1.0000	95.4930	**0.3**
0.4	0.0006	0.0000	0.5000	1.0000	0.0023	0.0000	0.1182	0.6667	0.3333	1.0000	71.6198	**0.4**
0.5	0.0007	0.0000	0.5000	1.0000	0.0029	0.0001	0.1321	0.6667	0.3333	1.0000	57.2958	**0.5**
0.6	0.0009	0.0000	0.5000	1.0000	0.0035	0.0001	0.1447	0.6667	0.3333	1.0000	47.7465	**0.6**
0.7	0.0010	0.0000	0.5000	1.0000	0.0041	0.0001	0.1563	0.6667	0.3333	1.0000	40.9256	**0.7**
0.8	0.0012	0.0000	0.5000	1.0000	0.0047	0.0001	0.1671	0.6667	0.3333	1.0000	35.8099	**0.8**
0.9	0.0013	0.0000	0.5000	1.0000	0.0052	0.0002	0.1772	0.6667	0.3333	1.0000	31.8310	**0.9**
1.0	0.0015	0.0001	0.5000	1.0000	0.0058	0.0002	0.1868	0.6667	0.3333	1.0000	28.6479	**1.0**
1.1	0.0016	0.0001	0.5000	1.0000	0.0064	0.0002	0.1960	0.6667	0.3334	1.0000	26.0435	**1.1**
1.2	0.0018	0.0001	0.5000	1.0000	0.0070	0.0003	0.2046	0.6667	0.3334	1.0000	23.8733	**1.2**
1.3	0.0019	0.0001	0.5000	1.0000	0.0076	0.0003	0.2130	0.6667	0.3334	1.0000	22.0368	**1.3**
1.4	0.0020	0.0001	0.5000	0.9999	0.0081	0.0004	0.2211	0.6667	0.3334	1.0000	20.4628	**1.4**
1.5	0.0022	0.0001	0.5000	0.9999	0.0087	0.0005	0.2288	0.6667	0.3334	1.0000	19.0986	**1.5**
1.6	0.0023	0.0001	0.5000	0.9999	0.0093	0.0005	0.2363	0.6667	0.3334	1.0000	17.9049	**1.6**
1.7	0.0025	0.0001	0.5000	0.9999	0.0099	0.0006	0.2436	0.6667	0.3334	1.0000	16.8517	**1.7**
1.8	0.0026	0.0002	0.5000	0.9999	0.0105	0.0007	0.2507	0.6667	0.3334	1.0000	15.9155	**1.8**
1.9	0.0028	0.0002	0.5000	0.9999	0.0111	0.0007	0.2575	0.6667	0.3334	1.0000	15.0778	**1.9**
2.0	0.0029	0.0002	0.5000	0.9999	0.0116	0.0008	0.2642	0.6667	0.3334	1.0000	14.3240	**2.0**
2.1	0.0031	0.0002	0.5000	0.9999	0.0122	0.0009	0.2708	0.6667	0.3334	0.9999	13.6419	**2.1**
2.2	0.0032	0.0002	0.5000	0.9999	0.0128	0.0010	0.2771	0.6667	0.3334	0.9999	13.0218	**2.2**
2.3	0.0033	0.0003	0.5000	0.9998	0.0134	0.0011	0.2833	0.6667	0.3334	0.9999	12.4556	**2.3**
2.4	0.0035	0.0003	0.5000	0.9998	0.0140	0.0012	0.2894	0.6667	0.3334	0.9999	11.9366	**2.4**
2.5	0.0036	0.0003	0.5000	0.9998	0.0145	0.0013	0.2954	0.6667	0.3334	0.9999	1.45921	**2.5**
2.6	0.0038	0.0003	0.5000	0.9998	0.0151	0.0014	0.3013	0.6667	0.3334	0.9999	11.0184	**2.6**
2.7	0.0039	0.0004	0.5000	0.9998	0.0157	0.0015	0.3070	0.6668	0.3334	0.9999	10.6103	**2.7**
2.8	0.0041	0.0004	0.5000	0.9998	0.0163	0.0016	0.3126	0.6668	0.3334	0.9999	10.2314	**2.8**
2.9	0.0042	0.0004	0.5000	0.9998	0.0169	0.0017	0.3182	0.6668	0.3334	0.9999	9.8786	**2.9**
3.0	0.0044	0.0005	0.5000	0.9997	0.0175	0.0018	0.3236	0.6668	0.3334	0.9999	9.5493	**3.0**
3.1	0.0045	0.0005	0.5000	0.9997	0.0180	0.0020	0.3290	0.6668	0.3334	0.9999	9.2413	**3.1**
3.2	0.0046	0.0005	0.4999	0.9997	0.0186	0.0021	0.3342	0.6668	0.3334	0.9999	8.9525	**3.2**
3.3	0.0048	0.0006	0.4999	0.9997	0.0192	0.0022	0.3394	0.6668	0.3334	0.9999	8.6812	**3.3**
3.4	0.0049	0.0006	0.4999	0.9997	0.0198	0.0023	0.3445	0.6668	0.3335	0.9998	8.4259	**3.4**
3.5	0.0051	0.0006	0.4999	0.9996	0.0204	0.0025	0.3495	0.6668	0.3335	0.9998	8.1851	**3.5**
3.6	0.0052	0.0007	0.4999	0.9996	0.0209	0.0026	0.3545	0.6668	0.3335	0.9998	7.9578	**3.6**
3.7	0.0054	0.0007	0.4999	0.9996	0.0215	0.0028	0.3594	0.6668	0.3335	0.9998	7.7427	**3.7**
3.8	0.0055	0.0007	0.4999	0.9996	0.0221	0.0029	0.3642	0.6668	0.3335	0.9998	7.5389	**3.8**
3.9	0.0057	0.0008	0.4999	0.9995	0.0227	0.0031	0.3690	0.6668	0.3335	0.9998	7.3456	**3.9**
4.0	0.0058	0.0008	0.9999	0.9995	0.0233	0.0032	0.3737	0.6668	0.3335	0.9998	7.1620	**4.0**

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 4° - 8°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
4.0	0.0058	0.0008	0.4999	0.9995	0.0233	0.0032	0.3737	0.6668	0.3335	0.9998	7.1620	4.0
4.1	0.0060	0.0009	0.4999	0.9995	0.0238	0.0034	0.3783	0.6669	0.3335	0.9998	6.9873	4.1
4.2	0.0061	0.0009	0.4999	0.9995	0.0244	0.0036	0.3829	0.6669	0.3335	0.9998	6.8209	4.2
4.3	0.0063	0.0009	0.4999	0.9994	0.0250	0.0038	0.3874	0.6669	0.3335	0.9998	6.6623	4.3
4.4	0.0064	0.0010	0.4999	0.9994	0.0256	0.0039	0.3919	0.6669	0.3335	0.9997	6.5109	4.4
4.5	0.0065	0.0010	0.4999	0.9994	0.0262	0.0041	0.3963	0.6999	0.3335	0.9997	6.3662	4.5
4.6	0.0067	0.0011	0.4999	0.9994	0.0268	0.0043	0.4007	0.6669	0.3335	0.9997	6.2278	4.6
4.7	0.0068	0.0011	0.4999	0.9993	0.0273	0.0045	0.4051	0.6669	0.3336	0.9997	6.0953	4.7
4.8	0.0070	0.0012	0.4999	0.9993	0.0279	0.0047	0.4093	0.6669	0.3336	0.9997	5.9683	4.8
4.9	0.0071	0.0012	0.4999	0.9993	0.0285	0.0049	0.4136	0.6669	0.3336	0.9997	5.8465	4.9
5.0	0.0073	0.0013	0.4999	0.9992	0.0291	0.0051	0.4178	0.6669	0.3336	0.9997	5.7296	5.0
5.1	0.0074	0.0013	0.4999	0.9992	0.0297	0.0053	0.4219	0.6669	0.3336	0.9997	5.6172	5.1
5.2	0.0076	0.0014	0.4999	0.9992	0.0302	0.0055	0.4260	0.6670	0.3336	0.9996	5.5092	5.2
5.3	0.0077	0.0014	0.4999	0.9991	0.0308	0.0057	0.4301	0.6670	0.3336	0.9996	5.4053	5.3
5.4	0.0079	0.0015	0.4999	0.9991	0.0314	0.0059	0.4342	0.6670	0.3336	0.9996	5.3052	5.4
5.5	0.0080	0.0015	0.4999	0.9991	0.0320	0.0061	0.4382	0.6670	0.3336	0.9996	5.2087	5.5
5.6	0.0081	0.0016	0.4998	0.9990	0.0326	0.0064	0.4421	0.6670	0.3336	0.9996	5.1157	5.6
5.7	0.0083	0.0016	0.4998	0.9990	0.0331	0.0066	0.4461	0.6670	0.3337	0.9996	5.0259	5.7
5.8	0.0084	0.0017	0.4998	0.9990	0.0337	0.0068	0.4500	0.6670	0.3337	0.9995	4.9393	5.8
5.9	0.0086	0.0018	0.4998	0.9989	0.0343	0.0071	0.4538	0.6670	0.3337	0.9995	4.8556	5.9
6.0	0.0087	0.0018	0.4998	0.9989	0.0349	0.0073	0.4576	0.6671	0.3337	0.9995	4.7747	6.0
6.1	0.0089	0.0019	0.4998	0.9989	0.0355	0.0076	0.4614	0.6671	0.3337	0.9995	4.6964	6.1
6.2	0.0090	0.0020	0.4998	0.9988	0.0360	0.0078	0.4652	0.6671	0.3337	0.9995	4.6206	6.2
6.3	0.0092	0.0020	0.4998	0.9988	0.0366	0.0081	0.4690	0.6671	0.3337	0.9995	4.5473	6.3
6.4	0.0093	0.0021	0.4998	0.9988	0.0372	0.0083	0.4727	0.6671	0.3337	0.9994	4.4762	6.4
6.5	0.0095	0.0021	0.4998	0.9987	0.0378	0.0086	0.4763	0.6671	0.3337	0.9994	4.4074	6.5
6.6	0.0096	0.0022	0.4998	0.9987	0.0384	0.0088	0.4800	0.6671	0.3338	0.9994	4.3406	6.6
6.7	0.0097	0.0023	0.4998	0.9986	0.0389	0.0091	0.4836	0.6672	0.3338	0.9994	4.2758	6.7
6.8	0.0099	0.0023	0.4998	0.9986	0.0395	0.0094	0.4872	0.6672	0.3338	0.9994	4.2129	6.8
6.9	0.0100	0.0024	0.4998	0.9986	0.0401	0.0097	0.4908	0.6672	0.3338	0.9994	4.1519	6.9
7.0	0.0102	0.0025	0.4998	0.9985	0.0407	0.0099	0.4943	0.6672	0.3338	0.9993	4.0926	7.0
7.1	0.0103	0.0026	0.4997	0.9985	0.0413	0.0102	0.4978	0.6672	0.3338	0.9993	4.0349	7.1
7.2	0.0105	0.0026	0.4997	0.9984	0.0418	0.0105	0.5013	0.6672	0.3338	0.9993	3.9789	7.2
7.3	0.0106	0.0027	0.4997	0.9984	0.0424	0.0108	0.5048	0.6672	0.3339	8.9993	3.9244	7.3
7.4	0.0108	0.0028	0.4997	0.9983	0.0430	0.0111	0.5082	0.6673	0.3339	0.9993	3.8713	7.4
7.5	0.0109	0.0029	0.4997	0.9983	0.0436	0.0114	0.5117	0.6673	0.3339	0.9992	3.8197	7.5
7.6	0.0111	0.0029	0.4997	0.9982	0.0442	0.0117	0.5151	0.6673	0.3339	0.9992	3.7695	7.6
7.7	0.0112	0.0030	0.4997	0.9982	0.0447	0.0120	0.5184	0.6673	0.3339	0.9992	3.7205	7.7
7.8	0.0113	0.0031	0.4997	0.9982	0.0453	0.0123	0.5218	0.6673	0.3339	0.9992	3.6728	7.8
7.9	0.0115	0.0032	0.4997	0.9981	0.0459	0.0127	0.5251	0.6673	0.3339	0.9992	3.6263	7.9
8.0	0.0116	0.0032	0.4997	0.9981	0.0465	0.0130	0.5284	0.6674	0.3340	0.9991	3.5810	8.0

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 8° - 12°$

θ	Sx	Sx/R	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
8.0	0.0116	0.0032	0.4997	0.9981	0.0465	0.0130	0.5284	0.6674	0.3340	0.9991	3.5810	**8.0**
8.1	0.0118	0.0033	0.4997	0.9980	0.0471	0.0133	0.5317	0.6674	0.3340	0.9991	3.5368	**8.1**
8.2	0.0119	0.0034	0.4997	0.9980	0.0476	0.0136	0.5350	0.6674	0.3340	0.9991	3.4936	**8.2**
8.3	0.0121	0.0035	0.4997	0.9979	0.0482	0.0140	0.5383	0.6674	0.3340	0.9991	3.4516	**8.3**
8.4	0.0122	0.0036	0.4996	0.9979	0.0488	0.0143	0.5415	0.6674	0.3340	0.9990	3.4105	**8.4**
8.5	0.0124	0.0037	0.4996	0.9978	0.0494	0.0146	0.5447	0.6674	0.3340	0.9990	3.3703	**8.5**
8.6	0.0125	0.0038	0.4996	0.9978	0.0500	0.0150	0.5479	0.6675	0.3341	0.9990	3.3312	**8.6**
8.7	0.0127	0.0038	0.4996	0.9977	0.0505	0.0153	0.5511	0.6675	0.3341	0.9990	3.2929	**8.7**
8.8	0.0128	0.0039	0.4996	0.9976	0.0511	0.0157	0.5542	0.6675	0.3341	0.9990	3.2554	**8.8**
8.9	0.0129	0.0040	0.4996	0.9976	0.0517	0.0161	0.5574	0.6675	0.3341	0.9989	3.2189	**8.9**
9.0	0.0131	0.0041	0.4996	0.9975	0.0523	0.0164	0.5605	0.6675	0.3341	0.9989	3.1831	**9.0**
9.1	0.0132	0.0042	0.4996	0.9975	0.0529	0.0168	0.5636	0.6676	0.3341	0.9989	3.1481	**9.1**
9.2	0.0134	0.0043	0.4996	0.9974	0.0534	0.0172	0.5667	0.6676	0.3342	0.9989	3.1139	**9.2**
9.3	0.0135	0.0044	0.4996	0.9974	0.0540	0.0175	0.5698	0.6676	0.3342	0.9988	3.0804	**9.3**
9.4	0.0137	0.0045	0.4996	0.9973	0.0546	0.0179	0.5728	0.6676	0.3342	0.9988	3.0476	**9.4**
9.5	0.0138	0.0046	0.4995	0.9973	0.0552	0.0183	0.5759	0.6676	0.3342	0.9988	3.0156	**9.5**
9.6	0.0140	0.0047	0.4995	0.9972	0.0557	0.0187	0.5789	0.6677	0.3342	0.9988	2.9842	**9.6**
9.7	0.0141	0.0048	0.4995	0.9971	0.0563	0.0191	0.5819	0.6677	0.3343	0.9987	2.9534	**9.7**
9.8	0.0142	0.0049	0.4995	0.9971	0.0569	0.0195	0.5849	0.6677	0.3343	0.9987	2.9233	**9.8**
9.9	0.0144	0.0050	0.4995	0.9970	0.0575	0.0199	0.5879	0.6677	0.3343	0.9987	2.8937	**9.9**
10.0	0.0145	0.0051	0.4995	0.9970	0.0581	0.0203	0.5908	0.6677	0.3343	0.9987	2.8648	**10.0**
10.1	0.0147	0.0052	0.4995	0.9969	0.0586	0.0207	0.5938	0.6678	0.3343	0.9986	2.8364	**10.1**
10.2	0.0148	0.0053	0.4995	0.9968	0.0592	0.0211	0.5967	0.6678	0.3343	0.9986	2.8086	**10.2**
10.3	0.0150	0.0054	0.4995	0.9968	0.0598	0.0215	0.5996	0.6678	0.3344	0.9986	2.7813	**10.3**
10.4	0.0151	0.0055	0.4995	0.9967	0.0604	0.0219	0.6025	0.6678	0.3344	0.9985	2.7546	**10.4**
10.5	0.0153	0.0056	0.4994	0.9967	0.0609	0.0223	0.6054	0.6678	0.3344	0.9985	2.7284	**10.5**
10.6	0.0154	0.0057	0.4994	0.9966	0.0615	0.0228	0.6083	0.6679	0.3344	0.9985	2.7026	**10.6**
10.7	0.0156	0.0058	0.4994	0.9965	0.0621	0.0232	0.6111	0.6679	0.3344	0.9985	2.6774	**10.7**
10.8	0.0157	0.0059	0.4994	0.9965	0.0627	0.0236	0.6140	0.6679	0.3345	0.9984	2.6526	**10.8**
10.9	0.0158	0.0060	0.4994	0.9964	0.0633	0.0241	0.6168	0.6679	0.3345	0.9984	2.6282	**10.9**
11.0	0.0160	0.0061	0.4994	0.9963	0.0638	0.0245	0.6197	0.6680	0.3345	0.9984	2.6044	**11.0**
11.1	0.0161	0.0063	0.4994	0.9963	0.0644	0.0250	0.6225	0.6680	0.3345	0.9983	2.5809	**11.1**
11.2	0.0163	0.0064	0.4994	0.9962	0.0650	0.0254	0.6253	0.6680	0.3346	0.9983	2.5578	**11.2**
11.3	0.0164	0.0065	0.4994	0.9961	0.0656	0.0259	0.6281	0.6680	0.3346	0.9983	2.5352	**11.3**
11.4	0.0166	0.0066	0.4993	0.9961	0.0661	0.0263	0.6308	0.6681	0.3346	0.9982	2.5130	**11.4**
11.5	0.0167	0.0067	0.4993	0.9960	0.0667	0.0268	0.6336	0.6681	0.3346	0.9982	2.4911	**11.5**
11.6	0.0169	0.0068	0.4993	0.9959	0.0673	0.0272	0.6363	0.6681	0.3346	0.9982	2.4696	**11.6**
11.7	0.0170	0.0069	0.4993	0.9958	0.0679	0.0277	0.6391	0.6681	0.3347	0.9982	2.4485	**11.7**
11.8	0.0171	0.0071	0.4993	0.9958	0.0684	0.0282	0.6418	0.6682	0.3347	0.9981	2.4278	**11.8**
11.9	0.0173	0.0072	0.4993	0.9957	0.0690	0.0287	0.6445	0.6682	0.3347	0.9981	2.4074	**11.9**
12.0	0.0174	0.0073	0.4993	0.9956	0.0696	0.0292	0.6472	0.6682	0.3347	0.9981	2.3873	**12.0**

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 12° - 16°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	S.C.	R	θ
12.0	0.0174	0.0073	0.4993	0.9956	0.0696	0 0292	0.6472	0 6682	0.3347	0.9981	2.3873	**12.0**
12.1	0.0176	0.0074	0.4993	0.9956	0.0702	0.0296	0.6499	0.6682	0.3348	0.9980	2.3676	**12 1**
12.2	0.0177	0.0075	0.4992	0.9955	0.0708	0.0301	0 6526	0.6683	0.3348	0.9980	2.3482	**12.2**
12.3	0.0179	0.0077	0.4992	0.9954	0.0713	0.0306	0.6553	0.6683	0.3348	0.9980	2.3291	**12 3**
12.4	0.0180	0.0078	0.4992	0.9953	0.0719	0.0311	0.6579	0.6683	0.3348	0.9979	2.3103	**12.4**
12.5	0.0182	0.0079	0.4992	0.9953	0.0725	0.0316	0.6606	0.6683	0.3349	0.9979	2.2918	**12.5**
12.6	0.0183	0.0080	0.4992	0.9952	0.0731	0.0321	0.6632	0.6684	0.3349	0.9979	2 2736	**12.6**
12.7	0.0184	0.0082	0.4992	0.9951	0.0736	0.0326	0.6658	0.6684	0.3349	0 9978	2.2557	**12.7**
12.8	0.0186	0.0083	0.4992	0.9950	0.0742	0.0332	0.6684	0.6684	0.3349	0.9978	2.2381	**12.8**
12.9	0.0187	0.0084	0.4992	0.9949	0.0748	0.0337	0.6710	0.6685	0.3350	0.9978	2.2208	**12.9**
13.0	0.0189	0.0086	0.0991	0.9949	0.0754	0.0342	0.6736	0.6685	0.3350	0.9977	2.2037	**13.0**
13.1	0.0190	0.0087	0.4991	0.9948	0.0759	0.0347	0.6762	0.6685	0.3350	0.9977	2.1869	**13.1**
13.2	0.0192	0.0088	0.4991	0.9947	0.0765	0.0352	0.6788	0.6885	0.3350	0.9976	2.1703	**13.2**
13.3	0.0193	0.0090	0.4991	0.9946	0.0771	0.0358	0.6814	0.6686	3.3351	0.9976	2.1540	**13.3**
13.4	0.0195	0.0091	0.4991	0.9945	0.0777	0.0363	0.6839	0.6686	0.3351	0.9976	2.1379	**13.4**
13.5	0.0196	0.0092	0.4991	0.9945	0.0782	0.0369	0.6865	0.6686	0.3351	0.9975	2.1221	**13.5**
13.6	0.0197	0.0094	0.4991	3.9944	0.0788	0.0374	0.6890	0.6687	0.3351	0.9975	2.1065	**13.6**
13.7	0.0199	0.0095	0.4991	0.9943	0.0794	0.0380	0.6915	0.6687	0.3352	0.9975	2.0911	**13.7**
13.8	0.0200	0.0096	0.4990	0.9942	0.0800	0.0385	0.6941	0.6687	0.3352	0.9974	2.0759	**13.8**
13.9	0.0202	0.0098	0.4990	0.9941	0.0805	0.0391	0.6966	0.6687	0.3352	0.9974	2.0610	**13.9**
14.0	0.0203	0.0099	0.4990	0.9941	0.0811	0.0396	0.6991	0.6688	0.3352	0.9974	2.0463	**14.0**
14.1	0.0205	0.0101	0.4990	0.9940	0.0817	0.0402	0.7016	0.6688	0.3353	0.9973	2.0318	**14.1**
14.2	0.0206	0.0102	0.4990	0.9939	0.0823	0.0408	0.7040	0.6688	0.3353	0.9973	2.0175	**14.2**
14.3	0.0208	0.0104	0.4990	0.9938	0.0828	0.0413	0.7065	0.6689	0.3353	0.9972	2.0033	**14.3**
14.4	0.0209	0.0105	0.4990	0.9937	0.0834	0.0419	0 7090	0.6689	0.3354	0.9972	1.9894	**14.4**
14.5	0.0210	0.0106	0.4989	0.9936	0.0840	0.0425	0.7114	0.6689	0.3354	0.9972	1.9757	**14.5**
14.6	0.0212	0.0108	0.4989	0.9935	0.0846	0.0431	0.7139	0.6690	0.3354	0.9971	1.9622	**14.6**
14.7	0.0213	0.0109	0.4989	0.9934	0.0851	0.0437	0.7163	0.6690	0.3354	0.9971	1.9488	**14.7**
14.8	0.0215	0.0111	0.4989	0.9934	0.0857	0.0443	0.7188	0.6690	0.3355	0.9970	1.9357	**14.8**
14.9	0.0216	0.0112	0.4989	0.9933	0.0863	0.0449	0.7212	0.6690	0.3355	0.9970	1.9227	**14.9**
15.0	0.0218	0.0114	0.4989	0.9932	0.0868	0.0455	0.7236	0.6691	0.3355	0.9970	1.9099	**15.0**
15.1	0.0219	0.0115	0.4988	0.9931	0.0874	0.0461	0.7260	0.6691	0.3356	0.9969	1.8972	**15.1**
15.2	0.0221	0.0117	0.4988	0.9930	0.0880	0.0467	0.7284	0.6691	0 3356	0.9969	1.8847	**15.2**
15.3	0.0222	0.0119	0.4988	0.9929	0.0886	0.0473	0.7308	0.6692	0.3356	0.9968	1.8724	**15.3**
15.4	0.0223	0.0120	0.4988	0.9928	0.0891	0.0479	0.7332	0.6692	0 3356	0.9968	1.8603	**15.4**
15.5	0.0225	0.0122	0.4988	0.9927	0.0897	0.0485	0.7356	0.6692	0.3357	0.9968	1.8483	**15.5**
15.6	0.0226	0.0123	0.4988	0.9926	0.0903	0.0492	0.7379	0.8693	0.3357	0.9967	1.8364	**15.6**
15.7	0.0228	0.0125	0.4988	0.9925	0.0909	0.0498	0.7403	0.6693	0.3357	0.9967	1.8247	**15.7**
15.8	0.0229	0.0126	0.4987	0 9924	0 0914	0.0504	0.7427	0.6693	0.3358	0.9966	1.8132	**15.8**
15.9	0.0231	0 0128	0.4987	0.9923	0.0920	0.0511	0.7450	0.6694	0.3358	0.9966	1.8018	**15.9**
16.0	0.0232	0.0130	0.5987	0.9922	0.0926	0.0517	0.7473	0.6694	0.3358	0.9965	1.7905	**16.0**

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 16° - 20°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
16.0	0.0232	0.0130	0.4987	0.9922	0.0926	0.0517	0.7473	0.6694	0.3358	0.9965	1.7905	**16.0**
16.1	0.0234	0.0131	0.4987	0.9921	0.0931	0.0523	0.7497	0.6695	0.3359	0.9965	1.7794	**16.1**
16.2	0.0235	0.0133	0.4987	0.9920	0.0937	0.0530	0.7520	0.6695	0.3359	0.9965	1.7684	**16.2**
16.3	0.0236	0.0135	0.4987	0.9919	0.0943	0.0536	0.7543	0.6695	0.3359	0.9964	1.7575	**16.3**
16.4	0.0238	0.0136	0.4986	0.9918	0.0949	0.0543	0.7566	0.6696	0.3360	0.9964	1.7468	**16.4**
16.5	0.0239	0.0138	0.4986	0.9917	0.0954	0.0550	0.7589	0.6696	0.3360	0.9963	1.7362	**16.5**
16.6	0.0241	0.0139	0.4986	0.9916	0.0960	0.0556	0.7612	0.6696	0.3360	0.9963	1.7258	**16.6**
16.7	0.0242	0.0141	0.4986	0.9915	0.0966	0.0563	0.7635	0.6697	0.3361	0.9962	1.7154	**16.7**
16.8	0.0244	0.0143	0.4986	0.9914	0.0971	0.0570	0.7658	0.6697	0.3361	0.9962	1.7052	**16.8**
16.9	0.0245	0.0145	0.4986	0.9913	0.0977	0.0576	0.7681	0.6697	0.3361	0.9961	1.6951	**16.9**
17.0	0.0247	0.0146	0.4985	0.9912	0.0983	0.0583	0.7703	0.6698	0.3362	0.9961	1.6852	**17.0**
17.1	0.0248	0.0148	0.4985	0.9911	0.0989	0.0590	0.7726	0.6698	0.3362	0.9961	1.6753	**17.1**
17.2	0.0249	0.0150	0.4985	0.9910	0.0994	0.0597	0.7749	0.6698	0.3362	0.9960	1.6656	**17.2**
17.3	0.0251	0.0151	0.4985	0.9909	0.1000	0.0604	0.7771	0.6699	0.3363	0.9960	1.6559	**17.3**
17.4	0.0252	0.0153	0.4985	0.9908	0.1006	0.0611	0.7793	0.6699	0.3363	0.9959	1.6464	**17.4**
17.5	0.0254	0.0155	0.4985	0.9907	0.1011	0.0618	0.7816	0.6700	0.3363	0.9959	1.6370	**17.5**
17.6	0.0255	0.0157	0.4984	0.9906	0.1017	0.0625	0.7838	0.6700	0.3364	0.9958	1.6277	**17.6**
17.7	0.0257	0.0158	0.4984	0.9905	0.1023	0.0632	0.7860	0.6700	0.3364	0.9958	1.6185	**17.7**
17.8	0.0258	0.0160	0.4984	0.9904	0.1028	0.0639	0.7883	0.6701	0.3364	0.9957	1.6094	**17.8**
17.9	0.0259	0.0162	0.4984	0.9903	0.1034	0.0646	0.7905	0.6701	0.3365	0.9957	1.6004	**11.9**
18.0	0.0261	0.0164	0.4984	0.9902	0.1040	0.0653	0.7927	0.6702	0.3365	0.9956	1.5916	**18.0**
18.1	0.0262	0.0166	0.4983	0.9901	0.1046	0.0661	0.7949	0.6702	0.3365	0.9956	1.5828	**18.1**
18.2	0.0264	0.0168	0.4983	0.9900	0.1051	0.0668	0.7971	0.6702	0.3366	0.9955	1.5741	**18.2**
18.3	0.0265	0.0169	0.4983	0.9899	0.1057	0.0675	0.7992	0.6703	0.3366	0.9955	1.5655	**18.3**
18.4	0.0267	0.0171	0.4983	0.9897	0.1063	0.0682	0.8014	0.6703	0.3366	0.9954	1.5570	**18.4**
18.5	0.0268	0.0173	0.4983	0.9896	0.1068	0.0690	0.8036	0.6704	0.3367	0.9954	1.5485	**18.5**
18.6	0.0269	0.0175	0.4993	0.9895	0.1074	0.0697	0.8058	0.6704	0.3367	0.9953	1.5402	**18.6**
18.7	0.0271	0.0177	0.4982	0.9894	0.1080	0.0705	0.8079	0.6704	0.3368	0.9953	1.5320	**18.7**
18.8	0.0272	0.0179	0.4982	0.9893	0.1085	0.0712	0.8101	0.6705	0.3368	0.9952	1.5238	**18.8**
18.9	0.0274	0.0181	0.4982	0.9892	0.1091	0.0720	0.8122	0.6705	0.3368	0.9952	1.5158	**18.9**
19.0	0.0275	0.0183	0.4982	0.9891	0.1097	0.0727	0.8144	0.6706	0.3369	0.9951	1.5078	**19.0**
19.1	0.0277	0.0184	0.4982	0.9889	0.1102	0.0735	0.8165	0.6706	0.3369	0.9951	1.4999	**19.1**
19.2	0.0278	0.0186	0.4981	0.9888	0.1108	0.0743	0.8187	0.6706	0.3369	0.9950	1.4921	**19.2**
19.3	0.0280	0.0188	0.4981	0.9887	0.1114	0.0750	0.8208	0.6707	0.3370	0.9950	1.4843	**19.3**
19.4	0.0281	0.0190	0.4981	0.9886	0.1119	0.0758	0.8229	0.6707	0.3370	0.9949	1.4767	**19.4**
19.5	0.0282	0.0192	0.4981	0.9885	0.1125	0.0766	0.8250	0.6708	0.3371	0.9949	1.4691	**19.5**
19.6	0.0284	0.0194	0.4981	0.9884	0.1131	0.0774	0.8272	0.6708	0.3371	0.9948	1.4616	**19.6**
19.7	0.0285	0.0196	0.4980	0.9882	0.1136	0.0781	0.8293	0.6708	0.3371	0.9948	1.4542	**19.7**
19.8	0.0287	0.0198	0.4980	0.9881	0.1142	0.0789	0.8314	0.6709	0.3372	0.9947	1.4469	**19.8**
19.9	0.0288	0.0200	0.4980	0.9880	0.1148	0.0797	0.8335	0.6709	0.3372	0.9947	1.4396	**19.9**
20.0	0.0290	0.0202	0.4980	0.9879	0.1154	0.0805	0.8355	0.6710	0.3373	0.9946	1.4324	**20.0**

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 20° - 24°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
20.0	0.0290	0.0202	0.4980	0.9879	0.1154	0.0805	0.8355	0.6710	0.3373	0.9946	1.4324	**20.0**
20.1	0.0291	0.0204	0.4980	0.9878	0.1159	0.0813	0.8376	0.6710	0.3373	0.9945	1.4253	**20.1**
20.2	0.0293	0.0206	0.4979	0.9876	0.1165	0.0821	0.8397	0.6711	0.3373	0.9945	1.4182	**20.2**
20.3	0.0294	0.0208	0.4979	0.9875	0.1171	0.0829	0.8418	0.6711	0.3374	0.9944	1.4112	**20.3**
20.4	0.0295	0.0210	0.4979	0.9874	0.1176	0.0838	0.8439	0.6712	0.3374	0.9944	1.4043	**20.4**
20.5	0.0297	0.0212	0.4979	0.9873	0.1182	0.0846	0.8459	0.6712	0.3375	0.9943	1.3975	**20.5**
20.6	0.0298	0.0214	0.4979	0.9872	0.1188	0.0854	0.8480	0.6712	0.3375	0.9943	1.3907	**20.6**
20.7	0.0300	0.0217	0.4978	0.9870	0.1193	0.0862	0.8500	0.6713	0.3375	0.9942	1.3840	**20.7**
20.8	0.0301	0.0219	0.4978	0.9869	0.1199	0.0870	0.8521	0.6713	0.3376	0.9942	1.3773	**20.8**
20.9	0.0303	0.0221	0.4978	0.9868	0.1204	0.0879	0.8541	0.6714	0.3376	0.9441	1.3707	**20.9**
21.0	0.0304	0.0223	0.4978	0.9867	0.1210	0.0887	0.8562	0.6714	0.3377	0.9940	1.3642	**21.0**
21.1	0.0305	0.0225	0.4978	0.9865	0.1216	0.0895	0.8582	0.6715	0.3377	0.9940	1.3577	**21.1**
21.2	0.0307	0.0227	0.4977	0.9864	0.1221	0.0904	0.8602	0.6715	0.3377	0.9939	1.3513	**21.2**
21.3	0.0308	0.0229	0.4977	0.9863	0.1227	0.0912	0.8623	0.6716	0.3378	0.9939	1.3450	**21.3**
21.4	0.0310	0.0231	0.4977	0.9861	0.1233	0.0921	0.8643	0.6716	0.3378	0.9938	1.3387	**21.4**
21.5	0.0311	0.0233	0.4977	0.9860	0.1238	0.0929	0.8663	0.6717	0.3379	0.9938	1.3325	**21.5**
21.6	0.0313	0.0236	0.4976	0.9859	0.1244	0.0938	0.8683	0.6717	0.3379	0.9937	1.3263	**21.6**
21.7	0.0314	0.0238	0.4976	0.9858	0.1250	0.0947	0.8703	0.6718	0.3380	0.9936	1.3202	**21.7**
21.8	0.0315	0.0240	0.4976	0.9856	0.1255	0.0955	0.8723	0.6718	0.3380	0.9936	1.3141	**21.8**
21.9	0.0317	0.0242	0.4976	0.9855	0.1261	0.0964	0.8743	0.6718	0.3380	0.9935	1.3081	**21.9**
22.0	0.0318	0.0244	0.4976	0.9854	0.1267	0.0973	0.8763	0.6719	0.3381	0.9935	1.3022	**22.0**
22.1	0.0320	0.0247	0.4975	0.9852	0.1272	0.0981	0.8783	0.6719	0.3381	0.9934	1.2963	**22.1**
22.2	0.0321	0.0249	0.4975	0.9851	0.1278	0.0990	0.8803	0.6720	0.3382	0.9933	1.2904	**22.2**
22.3	0.0323	0.0251	0.4975	0.9850	0.1283	0.0999	0.8823	0.6720	0.3382	0.9933	1.2847	**22.3**
22.4	0.0324	0.0253	0.4975	0.9848	0.1289	0.1008	0.8843	0.6721	0.3383	0.9932	1.2789	**22.4**
22.5	0.0325	0.0256	0.4975	0.9847	0.1295	0.1017	0.8862	0.6721	0.3383	0.9932	1.2732	**22.5**
22.6	0.0327	0.0258	0.4974	0.9846	0.1300	0.1026	0.8882	0.6722	0.3384	0.9931	1.2676	**22.6**
22.7	0.0328	0.0260	0.4674	0.9844	0.1306	0.1035	0.8902	0.6722	0.3384	0.9930	1.2620	**22.7**
22.8	0.0330	0.0262	0.4974	0.9843	0.1312	0.1044	0.8921	0.6723	0.3384	0.9930	1.2565	**22.8**
22.9	0.0331	0.0265	0.4974	0.9842	0.1317	0.1053	0.8941	0.6723	0.3385	0.9929	1.2510	**22.9**
23.0	0.0333	0.0267	0.4973	0.9840	0.1323	0.1062	0.8960	0.6724	0.3385	0.9929	1.2456	**23.0**
23.1	0.0334	0.0269	0.4973	0.9839	0.1328	0.1071	0.8980	0.6724	0.3386	0.9928	1.2402	**23.1**
23.2	0.0335	0.0272	0.4973	0.9837	0.1334	0.1080	0.8999	0.6725	0.3386	0.9927	1.2348	**23.2**
23.3	0.0337	0.0274	0.4973	0.9836	0.1340	0.1090	0.9018	0.6725	0.3387	0.9927	1.2295	**33.3**
23.4	0.0338	0.0276	0.4972	0.9835	0.1345	0.1099	0.9038	0.6726	0.3387	0.9926	1.2243	**23.4**
23.5	0.0340	0.0279	0.4972	0.9833	0.1351	0.1108	0.9057	0.6726	0.3388	0.9925	1.2191	**23.5**
23.6	0.0341	0.0281	0.4972	0.9832	0.1356	0.1117	0.9076	0.6727	0.3388	0.9925	1.2139	**23.6**
23.7	0.0343	0.0283	0.4972	0.9830	0.1362	0.1127	0.9096	0.6727	0.3389	0.9924	1.2088	**23.7**
23.8	0.0344	0.0286	0.4971	0.9829	0.1368	0.1136	0.9115	0.6728	0.3389	0.9924	1.2037	**23.8**
23.9	0.0346	0.0288	0.4971	0.9827	0.1373	0.1146	0.9134	0.6729	0.3390	0.9923	1.1987	**23.9**
24.0	0.0347	0.0291	0.4971	0.9826	0.1379	0.1155	0.9153	0.6729	0.3390	0.9922	1.1937	**24.0**

Appendix 5

TABLE 12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 24° - 28°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
24.0	0.0347	0.0291	0.4971	0.9826	0.1379	0.1155	0.9153	0.6729	0.3390	0.9922	1.1937	**24.0**
24.1	0.0348	0.0293	0.4971	0.9825	0.1385	0.1165	0.9172	0.6730	0.3391	0.9922	1.1887	**24.1**
24.2	0.0350	0.0295	0.4970	0.9823	0.1390	0.1174	0.9191	0.6730	0.3391	0.9921	1.1838	**24.2**
24.3	0.0351	0.0298	0.4970	0.9822	0.1396	0.1184	0.9210	0.6731	0.3392	0.9920	1.1789	**24.3**
24.4	0.0353	0.0300	0.4970	0.9820	0.1401	0.1193	0.9229	0 6731	0.3392	0.9920	1.1741	**24.4**
24.5	0.0354	0.0303	0.4970	0.9819	0.1407	0.1203	0.9248	0.6732	0.3393	0.9919	1.1693	**24.5**
24.6	0.0355	0.0305	0.4969	0.9817	0.1412	0.1213	0.9267	0.6732	0.3393	0.9918	1.1645	**24.6**
24.7	0.0357	0.0308	0.4969	0.9816	0.1418	0.1223	0.9285	0.6733	0.3394	0.9918	1.1598	**24.7**
24.8	0.0358	0.0310	0.4969	0.9814	0.1424	0.1232	0.9304	0.6733	0.3394	0.9917	1.1552	**24.8**
24.9	0.0360	0.0313	0 4969	0.9813	0.1429	0 1242	0.9323	0.6734	0.3395	0 9916	1.1505	**24.9**
25.0	0.0361	0.0315	0.4968	0.9811	0.1435	0.1252	0.9342	0.6734	0.3395	0.9916	1.1459	**25.0**
25.1	0.0363	0.0318	0.4968	0.9810	0.1440	0.1262	0.9360	0.6735	0.3396	0.9915	1 1414	**25.1**
25.2	0.0364	0.0320	0.4968	0.9808	0.1446	0.1272	0.9379	0.6736	0.3396	0.9914	1.1368	**25.2**
25.3	0.0365	0.0323	0.4968	0.9807	0.1452	0.1282	0.9398	0.6736	0.3397	0.9914	1.1323	**25.3**
25.4	0.0367	0.0325	0.4967	0.9805	0.1457	0.1292	0.9416	0.6737	0.3397	0.9913	1.1279	**25.4**
25.5	0.0368	0.0328	0.4967	0.9804	0.1463	0.1302	0.9435	0.6737	0.3398	0.9912	1.1234	**25.5**
25.6	0.0370	0.0330	0.4967	0.9802	0.1468	0.1312	0.9453	0.6738	0.3398	0.9912	1.1191	**25.6**
25.7	0.0371	0.0333	0.4967	0 9801	0.1474	0.1322	0.9472	0.6738	0.3399	0.9911	1.1147	**25.7**
25.8	0.0373	0.0335	0.4966	0.9799	0.1479	0.1332	0.9490	0.6739	0.3399	0.9910	1.1104	**25.8**
25.9	0.0374	0.0338	0.4966	0.9798	0.1485	0.1342	0.9508	0.6740	0.3400	0.9910	1.1061	**25.9**
26.0	0.0375	0.0341	0.4966	0.9796	0.1491	0.1353	0.9527	0.6740	0.3400	0.9909	1.1018	**26.0**
26.1	0.0377	0.0343	0.4966	0.9795	0.1496	0.1363	0.9545	0.6741	0.3401	0.9908	1.0976	**26.1**
26.2	0.0378	0.0346	0.4965	0.9793	0.1502	0.1373	0.9563	0.6741	0.3401	0 9907	1 0934	**26.2**
26.3	0.0380	0.0348	0.4965	0.9791	0.1507	0.1384	0.9581	0.6742	0.3402	0.9907	1.0893	**26.3**
26.4	0.0381	0.0351	0.4965	0.9790	0.1513	0.1394	0.9600	0.6742	0.3402	0.9906	1.0851	**26.4**
26.5	0.0383	0.0354	0.4965	0.9788	0.1518	0.1404	0.9618	0.6743	0.3403	0.9905	1.0811	**26.5**
26.6	0.0384	0.0356	0.4964	0.9787	0.1524	0.1415	.0 9636	0.6744	0 3403	0.9905	1.0770	**26.6**
26.7	0.0385	0.0359	0.4964	0.9785	0.1529	0.1425	0.9654	0.6744	0.3404	0.9904	1.0730	**26.7**
26.8	0.0387	0.0362	0.4964	0.9783	0.1535	0.1436	0.9672	0.6745	0.3404	0 9903	1.0690	**26.8**
26.9	0.0388	0.0365	0.4964	0.9782	0.1541	0.1446	0.9690	0.6745	0.3405	0.9902	1.0650	**26.9**
27.0	0.0390	0.0367	0.4963	0.9780	0.1546	0.1457	0.9708	0.6746	0.3406	0.9902	1.0610	**27.0**
27.1	0.0391	0.0370	0.4963	0.9779	0.1552	0.1468	0.9726	0.6747	0.3406	0.9901	1.0571	**27.1**
27.2	0.0392	0.0373	0.4963	0.9777	0.1557	0.1478	0.9744	0.6747	0.3407	0.9900	1.0532	**27.2**
27.3	0.0394	0.0375	0.4962	0.9775	0.1563	0.1489	0.9762	0.6748	0.3407	0.9900	1.0494	**27.3**
27.4	0.0395	0.0378	0.4962	0.9774	0.1568	0.1500	0.9780	0.6748	0.3408	0.9899	1.0455	**27.4**
27.5	0.0397	0.0381	0.4962	0.9772	0.1574	0.1511	0.9798	0.6749	0.3408	0.9898	1.0417	**27.5**
27.6	0.0398	0.0384	0.4962	0.9770	0.1579	0.1521	0.9815	0.6750	0.3409	0.9897	1.0380	**27.6**
27.7	0.0400	0.0386	0.4961	0.9769	0.1585	0.1532	0.9833	0.6750	0.3409	0 9887	1 0342	**27.7**
27.8	0.0401	0.0389	0.4961	0.9767	0.1590	0.1543	0.9851	0.6751	0.3410	0.9896	1.0305	**27.8**
27.9	0.0402	0.0392	0.4961	0.9766	0.1596	0.1554	0.9869	0.6751	0.3411	0.9895	1.0268	**27.9**
28.0	0.0404	0.0395	0.4961	0.9764	0.1601	0.1565	0.9886	0.6752	0.3411	0.9894	1.0231	**28.0**

Appendix 4

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

θ=28°—32°

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
28.0	0.0404	0.0395	0.4961	0.9764	0.1601	0.1565	0.9886	0.6752	0 3411	0.9894	1.0231	**28.0**
28.1	0.0405	0.0397	0.4960	0.9762	0.1607	0.1576	0 9904	0.6753	0.3412	0.9894	1.0195	**28.1**
28.2	0.0407	0.0400	0.4960	0.9760	0.1612	0.1587	0.9922	0.6753	0.3412	0.9893	1.0159	**28.2**
28.3	0.0408	0.0403	0.4960	0.9759	0.1618	0.1598	0.9939	9.6754	0.3413	0.9892	1.0123	**28.3**
28.4	0 0409	0.0406	0.4959	0.9757	0 1624	0.1610	0.9957	0.6755	0.3413	0.9891	1.0087	**28.4**
28.5	0.0411	0.0409	0.4959	0.9755	0.1629	0.1621	0.9974	0.6755	0.3414	0.9891	1.0052	**28.5**
28.6	0.0412	0.0412	0.4959	0.9754	0.1635	0.1632	0.9992	0.6756	0.3415	0.9890	1.0017	**28.6**
28.7	0.0414	0.0414	0.4958	0.9752	0.1640	0.1643	1.0009	0.6757	0.3415	0.9889	0.9982	**28.7**
28.8	0.0415	0.0417	0.4958	0.9750	0.1646	0.1654	1.0027	0.6757	0.3416	0.9888	0.9947	**28.8**
28.9	0 0417	0 0420	0.4958	0.9749	0.1651	0.1665	1.0044	0.6758	0.3416	0.9887	0 9913	**28.9**
29.0	0 0418	0.0423	0.4958	0.9747	0.1657	0.1677	1.0061	0.6758	0.3417	0.9887	0 9879	**29.0**
29.1	0 0419	0.0426	0.4957	0.9745	0.1662	0.1688	1.0079	0 6759	0.3417	0.9886	0 9845	**29.1**
29.2	0.0421	0.0429	0.4957	0.9743	0.1668	0.1700	1.0096	0.6760	0.3417	0.9885	0.9811	**29.2**
29.3	0.0422	0.0432	0.4957	0.9742	0.1673	0.1711	1.0113	0.6760	0.3418	0.9884	0.9777	**29.3**
29.4	0.0424	0.0435	0.4956	0.9740	0.1679	0.1723	1.0130	0.6761	0.3419	0.9884	0 9744	**29.4**
29.5	0.0425	0.0438	0.4956	0.9738	0.1684	0.1734	1.0148	0.6762	0.3420	0.9883	0.9711	**29.5**
29.6	0.0426	0.0441	0.4956	0.9736	0.1690	0.1746	1.0165	0.6762	0.3421	0.9882	0.9678	**29.6**
29.7	0.0428	0.0444	0.4956	0.9735	0.1695	0.1757	1.0182	0.6763	0.3421	0.9881	0.9646	**29.7**
29.8	0.0429	0.0447	0.4955	0.9733	0.1701	0.1769	1.0199	0.6764	0.3422	0.9880	0.9613	**29.8**
29.9	0.0431	0.0450	0.4955	0 9731	0.1706	0.1781	1.0216	0.6764	0.3422	0.9880	0.9531	**29.9**
30.0	0.0432	0.0453	0.4955	0.9729	0.1711	0.1792	1 0233	0.6765	0.3423	0.9879	0.9549	**30.0**
30.1	0.0434	0.0455	0.4954	0.9728	0.1717	0.1804	1.0250	0 6766	0.3424	0.9878	0.9518	**30.1**
30.2	0.0435	0.0458	0.4954	0.9726	0.1722	0.1816	1.0267	0.6766	0.3424	0.9877	0.9186	**30.2**
30.3	0 0436	0 0461	0.4954	0.9724	0.1728	0.1828	1.0284	0.6767	0.3425	0.9876	0.9455	**30.3**
30.4	0.0438	0.0464	0.4953	0.9722	0.1733	0.1839	1.0301	0 6768	0.3425	0.9876	0.9424	**30.4**
30.5	0 0439	0.0467	0.4953	0.9720	0.1739	0.1851	1.0318	0.6768	0.3426	0.9875	0 9393	**30.5**
30.6	0 0441	0.0471	0.4953	0.9719	0.1744	0.1863	1.0335	0.6769	0.3427	0.9874	0.9362	**30.6**
30.7	0 0442	0.0474	0 4953	0.9717	0.1750	0.1875	1.0352	0.6770	0.3427	0.9873	0.9332	**30.7**
30.8	0 0443	0.0477	0.4952	0.9715	0.1755	0.1887	1.0369	0 6771	0.3428	0.9872	0.9301	**30.8**
30.9	0.0445	0.0480	0.4952	0.9713	0.1761	0.1899	1.0386	0.6771	0.3429	0.9871	0.9271	**30.9**
31.0	0.0446	0.0483	0.4952	0.9711	0.1766	0.1911	1.0402	0.6772	0.3429	0.9871	0.9241	**31.0**
31.1	0.0448	0.0486	0.4951	0.9709	0.1772	0.1923	1.0419	0.6773	0.3430	0.9870	0.9212	**31.1**
31.2	0.0449	0.0489	0.4951	0.9708	0.1777	0.1935	1.0436	0.6773	0.3430	0.9869	0.9182	**31.2**
31.3	0.0450	0.0492	0.4951	0.9706	0.1783	0.1947	1.0453	0.6774	0.3431	0.9868	0.9153	**31.3**
31.4	0.0452	0.0495	0.4950	0.9704	0.1788	0.1960	1.0469	0.6775	0.3432	0.9867	0.9124	**31.4**
31.5	0.0453	0.0498	0.4950	0.9702	0.1793	0.1972	1.0486	0.6775	0.3432	0.9866	0.9095	**31.5**
31.6	0.0455	0.0501	0.4950	0.9700	0.1799	0.1984	1.0503	0.6776	0.3433	0.9866	0.9066	**31.6**
31.7	0.0456	0.0505	0.4949	0.9698	0.1804	0.1997	1.0519	0.6777	0.3434	0.9865	0 9037	**31.7**
31.8	0.0457	0.0508	0.4949	0.9696	0.1810	0.2009	1.0536	0.6778	0.3434	0.9864	0.9009	**31.8**
31.9	0.0459	0 0511	0.4949	0 9694	0.1815	0.2021	1 0552	0.6778	0.3435	0.9863	0.8081	**31.9**
32.0	0.0460	0.0514	0.4948	0.9693	0.1821	0.2034	1.0569	0.6779	0.3436	0.9862	0.8952	**32.0**

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

θ = 32°—36°

θ	Sx	Sx/R	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
32.0	0.0460	0.0514	0.4948	0.9693	0.1821	0.2034	1 0569	0.6779	0.3436	0.9862	0.8952	32.0
32.1	0.0462	0.0517	0.4948	0.9691	0.1826	0.2046	1.0585	0.6780	0.3436	0.9861	0.8925	32.1
32.2	0.0463	0.0520	0.4948	0.9689	0.1832	0.2059	1.0602	0.6780	0.3437	0.9860	0.8897	32.2
32.3	0.0465	0.0524	0.4948	0.9687	0.1837	0.2071	1.0618	0.6781	0.3438	0,9860	0.8869	32.3
32.4	0.0466	0.0527	0.4947	0.9685	0.1842	0.2084	1.0635	0.6782	0 3438	0 9859	0.8842	32.4
32.5	0.0467	0.0530	0.4947	0.9683	0.1848	0.2096	1.0651	0.6783	0.3439	0.9858	0.8815	32.5
32.6	0 0469	0.0533	0.4947	0.9681	0.1853	0.2109	1.0668	0.6783	0.3440	0.9857	0.8788	32.6
32.7	0.0470	0.0537	0.4946	0.9679	0.1859	0.2121	1.0684	0.6784	0.3440	0.9856	0.8761	32.7
32.8	0.0472	0.0540	0.4946	0.9677	0.1864	0.2134	1 0700	0.6785	0.3441	0.9855	0.8734	32.8
32.9	0.0473	0.0543	0.4946	0.9675	0.1869	0.2147	1.0717	0.6786	0.3442	0.9854	0.8708	32.9
33.0	0.0474	0.0546	0.4945	0.9673	0.1875	0.2160	1.0733	0.6786	0.3442	0.9853	0 8681	33.0
33.1	0.0476	0.0550	0.4945	0.9671	0.1880	0.2173	1.0749	0.6787	0 3443	0.9853	0.8655	33.1
33.2	0.0477	0.0553	0.4945	0.9669	0.1886	0.2185	1.0765	0.6788	0.3444	0 9852	0.8629	33.2
33.3	0.0479	0.0556	0.4944	0.9667	0.1891	0.2198	1.0781	0.6789	0.3444	0.9851	0 8603	33.3
33.4	0.0480	0.0560	0.4944	0.9666	0.1897	0.2211	1.0798	0.6789	0.3445	0 9850	0 8577	33.4
33.5	0.0481	0.0563	0.4944	0.9664	0.1902	0.2224	1.0814	0.6790	0.3446	0.9849	0 8552	33.5
33.6	0.0483	0.0566	0.4943	0.9662	0.1907	0.2237	1.0830	0.6791	0.3447	0.9848	0.8526	33.6
33.7	0.0484	0.0569	0.4943	0.9660	0.1913	0.2250	1.0846	0.6792	0.3447	0.9847	0.8501	33.7
33.8	0.0486	0.0573	0.4943	0.9658	0.1918	0.2263	1.0862	0.6792	0.3448	0.9846	0.8476	33.8
33.9	0.0487	0.0576	0.4942	0.9656	0.1923	0.2276	1.0878	0.6793	0.3449	0.9845	0.8451	33.9
34.0	0.0488	0.0580	0.4942	0.9654	0.1929	0.2289	1.0894	0.6794	0.3449	0.9844	0 8426	34.0
34.1	0.0490	0.0583	0.4942	0.9652	0.1934	0.2302	1.0910	0.6795	0.3450	0.9844	0.8401	34.1
34.2	0.0491	0.0586	0.4941	0.9650	0.1940	0.2315	1.0926	0.6796	0.3451	0.9443	0.8377	34.2
34.3	0.0493	0.0590	0.4941	0.9648	0.1945	0.2329	1.0942	0.6796	0.3452	0.9842	0.8352	34.3
34.4	0.0494	0.0593	0.4941	0.9646	0.1950	0.2342	1.0958	0.6797	0.3452	0.9841	0.8328	34.4
34.5	0.0495	0.0596	0.4940	0.9644	0.1956	0.2355	1.0974	0.6798	0.3453	0 9840	0.8304	34.5
34.6	0.0497	0.0600	0.4940	0.9641	0.1961	0.2368	1.0990	0.6799	0.3454	0.9839	0.8280	34.6
34.7	0.0498	0.0603	0.4940	0.9639	0.1967	0.2382	1.1006	0.6799	0.3454	0.9838	0.8256	34.7
34.8	0.0500	0.0607	0.4939	0.9637	0.1972	0 2395	1.1022	0.6800	0.3455	0.9837	0 8232	34.8
34.9	0.0501	0.0610	0.4939	0.9535	0.1977	0.2409	1.1037	0.6801	0.3456	0.9836	0.8209	34.9
35.0	0.0502	0.0614	0.4939	0.9633	0.1983	0.2422	1.1053	0.6802	0.3457	0.9835	0.8185	35.0
35.1	0.0504	0.0617	0.4938	0.9631	0.1988	0.2436	1.1069	0.6803	0.3457	0 9834	0.8162	35 1
34.2	0.0505	0.0621	0.4938	0.9629	0.1993	0.2449	1.1085	0.6803	0.3458	0.9833	0.8139	35.2
35.3	0.0507	0.0624	0.4937	0.9627	0.1999	0.2463	1.1100	0.6804	0.3459	0.9832	0.8116	35.3
35.4	0.0508	0.0628	0.4937	0.9625	0.2004	0.2476	1.1116	0.6805	0.3460	0.9831	0.8093	35.4
35.5	0.0509	0.0631	0.4937	0.9623	0.2009	0.2490	0.1132	0.6806	0.3460	0.9830	9.8070	35.5
35.6	0.0511	0.0638	0.4936	0.9621	0.2015	0.2504	1.1148	0.6807	0.3461	0.9830	0.8047	35.6
35.7	0.0512	0.0628	0.4936	0.9619	0.2020	0.2517	1.1163	0.6808	0.3462	0.9829	0.8025	35.7
35.8	0.0514	0.0642	0.4936	0.9617	0.2025	0.2531	1.1179	0.6808	0.3463	0.9828	0.8002	35.8
35.9	0.0515	0.0645	0.4935	0.9615	0.2031	0.2545	1.1194	0 6809	0.3463	0.9827	0.7980	35.9
36.0	0.0516	0.0649	0.4935	0.9612	0.2036	0.2559	1.1210	0 6810	0.3464	0.9826	9.7958	36.0

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 36° - 40°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
36.0	0.0516	0.0649	0.4935	0.9612	0.2036	0.2559	1.1210	0.6810	0.3464	0.9826	0.7958	36.0
36.1	0.0518	0.0652	0.4935	0.9610	0.2041	0.2572	1.1226	0.6811	0.3465	0.9825	0.7936	36.1
36.2	0.0519	0.0656	0.4934	0.9608	0.2047	0.2586	1.1241	0.6812	0.3466	0.9824	0.7914	36.2
36.3	0.0520	0.0659	0.4934	0.9606	0.2052	0.2600	1.1257	0.6813	0.3466	0.9823	0.7892	36.3
36.4	0.0522	0.0663	0.4934	0.9604	0.2057	0.2614	1.1272	0.6813	0.3467	0.9822	0.7870	36.4
36.5	0.0523	0.0667	0.4933	0.9602	0.2063	0.2628	1.1288	0.6814	0.3468	0.9821	0.7849	36.5
36.6	0.0525	0.0670	0.4933	0.9600	0.2068	0.2642	1.1303	0 6815	0.3469	0.9820	0.7827	36.6
36.7	0.0526	0.0674	0.4932	0.9597	0.2073	0.2656	1.1319	0.6816	0.3469	0.9819	0.7806	36.7
36.8	0.0527	0.0677	0.4932	0.9595	0.2079	0.2670	1.1334	0.6817	0.3470	0.9818	0.7785	36.8
36.9	0.0529	0.0681	0.4932	0.9593	0.2084	0.2684	1.1349	0.6818	0.3471	0.9817	0.7764	36.9
37.0	0.0530	0.0685	0.4931	0.9591	0.2089	0.2698	1.1365	0.6818	0.3472	0.9816	0.7743	37 0
37.1	0.0532	0.0688	0.4931	0.9589	0.2095	0.2713	1.1380	0.6819	0.3473	0.9815	0.7722	37.1
37.2	0.0533	0.0692	0.4931	0.9587	0.2100	0.2727	1.1395	0.6820	0.3473	0.9814	0.7701	37.2
37.3	0.0534	0.0696	0.4930	0.9584	0.2105	0.2741	1.1411	0.6821	0.3474	0.9813	0.7680	37.3
37.4	0.0536	0.0699	0.4930	0.9582	0.2111	0.2755	1.1426	0.6822	0.3475	0.9812	0.7660	37.4
37.5	0.0537	0.0703	0.4930	0.9580	0.2116	0.2770	1.1441	0.6823	0.3476	0.9811	0.7639	37.5
37.6	0.0539	0.0707	0.4929	0.9578	0.2121	0.2784	1.1456	0.6824	0.3476	0.9810	0.7619	37.6
37.7	0.0540	0.0710	0.4929	0.9576	0.2126	0.2798	1.1472	0.6824	0.3477	0.9809	0.7599	37.7
37.8	0.0541	0.0714	0.4928	0.9573	0.2132	0.2813	1.1487	0.6825	0.3478	0.9808	0.7579	37.8
37.9	0.0543	0.0718	0.4928	0.9571	0.2137	0.2827	1.1502	0.6826	0.3479	0.9807	0.7559	37.9
38.0	0.0544	0.0722	0.4928	0.9569	0.2142	0.2842	1.1517	0.6827	0.3480	0.9806	0.7539	38.0
38.1	0.0546	0.0726	0.4927	0.9567	0.2148	0.2856	1.1532	0.6828	0.3480	0.9805	0.7519	38.1
38.2	0.0547	0.0729	0.4927	0.9565	0.2153	0.2871	1.1547	0.6829	0.3481	0.9804	0.7499	38.2
38.3	0.0548	0.0733	0.4926	0.9562	0.2158	0.2885	1.1563	0.6830	0.3482	0.9803	0.7480	38.3
38.4	0.0550	0.0737	0.4926	0.9560	0.2163	0.2900	1.1578	0.6831	0.3483	0.9802	0.7460	38.4
38.5	0.0551	0.0740	0.4926	0.9558	0.2169	0.2914	1.1593	0.6832	0.3484	0.9801	0.7441	38.5
38.6	0.0552	0.0744	0.4925	0.9556	0.2174	0.2929	1.1608	0.6832	0.3485	0.9800	0.7422	38.6
38.7	0.0554	0.0748	0.4925	0.9553	0.2179	0.2944	1.1623	0.6833	0.3485	0.9799	0.7403	38.7
38.8	0.0555	0.0752	0.4925	0.9551	0.2184	0.2959	1.1638	0.6834	0.3486	0.9798	0.7383	38.8
38.9	0.0557	0.0756	0.4924	0.9540	0.2190	0.2974	1.1653	0.6835	0.3487	0.9797	0.7364	38.9
39.0	0.0558	0.0759	0.4924	0.9547	0.2195	0.2988	1.1668	0.6836	0.3488	0.9796	0.7346	39.0
39.1	0.0559	0.0763	0.4923	0.9544	0.2200	0.3003	1.1683	0.6837	0.3489	0.9795	0.7327	39.1
39.2	0.0561	0.0767	0.4923	0.9542	0.2205	0.3018	1.1698	0.6838	0.3490	09794	0.7308	39.2
39.3	0.0562	0.0771	0.4923	0.9540	0.2211	0.3033	1.1713	0.6839	0.3490	0.9793	0.7290	39.3
39.4	0.0563	0.0775	0.4922	0.9537	0.2216	0.3048	1.1727	0.6840	0.3491	0.9791	0.7271	39.4
39.5	0.0565	0.0779	0.4922	0.9535	0.2221	0.3062	1.1742	0.6341	0.3492	0.9790	0.7253	39.5
39.6	0.0566	0.0783	0.4921	0.9533	0.2226	0.3078	1.1757	0.6842	0.3493	0.9789	0.7234	39.6
39.7	0.0568	0.0787	0.4921	0.9531	0.2232	0.3093	1.1772	0.6842	0.3494	0.9788	0.7216	39.7
39.8	0.0569	0.0791	0.4921	0.9528	0.2237	0.3108	1.1787	0.6843	0.3495	0.9787	0.7198	39.8
39.9	0.0570	0.0794	0.4920	0.9526	0.2242	0.3123	1.1802	0.6844	0.3495	0.9786	0.7180	39.9
40.0	0.0572	0.0798	0.4920	0.9524	0.2247	0.3138	1.1816	0.6845	0.3496	0.9785	0.7162	40.0

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 40° - 44°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T..	L.C.	R	θ
40.0	0.0572	0.0798	0.4920	0.9524	0.2247	0.3138	1.1816	0.6845	0.3496	0.9785	0.7162	**40.0**
40.1	0.0573	0.0802	0.4920	0.9521	0.2253	0.3153	1.1831	0.6846	0.3497	0.9784	0.7144	**40.1**
40.2	0.0575	0.0806	0.4919	0.9519	0.2258	0.3168	1.1846	0.6847	0.3498	0.9783	0.7126	**40.2**
40.3	0.0576	0.0810	0.4919	0.9517	0.2263	0.3183	1.1861	0.6848	0.3499	0.9782	0.7109	**40.3**
40.4	0.0577	0.0814	0.4918	0.9514	0.2268	0.3199	1.1875	0.6849	0.3500	0.9781	0.7091	**40.4**
40.5	0.0579	0.0818	0.4918	0.9512	0.2273	0.3214	1.1890	0.6850	0.3501	0.9780	0.7074	**40.5**
40.6	0.0580	0.0822	0.4918	0.9509	0.2279	0.3229	1.1905	0.6851	0.3501	0.9779	0.7056	**40.6**
40.7	0.0581	0.0826	0.4917	0.9507	0.2284	0.3244	1.1919	0.6852	0.3502	0.9778	0.7039	**40.7**
40.8	0.0583	0.0830	0.4917	0.9505	0.2289	0.3260	1.1934	0.6853	0.3503	0.9777	0.7022	**40.8**
40.9	0.0584	0.0834	0.4916	0.9502	0.2294	0.3276	1.1949	0.6854	0.3504	0 9775	0.7004	**40 9**
41.0	0.0586	0.0838	0.4916	0.9500	0.2299	0.3291	1.1963	0.6855	0.3505	0.9774	0.6987	**41.0**
41.1	0.0587	0.0842	0.4916	0.9498	0.2305	0.3306	1.1978	0.6856	0.3506	0.9773	0.6970	**41.1**
41.2	0.0588	0.0846	0.4915	0.9495	0.2310	0.3322	1.1992	0.6857	0.3507	0.9772	0 6953	**41.2**
41.3	0.0590	0.0850	0.4915	0.9493	0.2315	0.3337	1.2007	0.6858	0.3508	0.9771	0.6937	**41.3**
41.4	0.0591	0.0854	0.4914	0.9490	0.2320	0.3353	1.2021	0.6859	0.3509	0.9770	0.6920	**41.4**
41.5	0.0592	0.0858	0.4914	0.9488	0.2325	0.3369	1.2036	0.6860	0.3509	0.9769	0.6903	**41.5**
41.6	0.0594	0.0862	0.4913	0.9486	0.2331	0.3384	1.2050	0.6861	0 3510	0.9768	0.6887	**41.6**
41.7	0.0595	0.0866	0.4913	0.9483	0.2336	0.3400	1.2065	0.6862	0.3511	0.9767	0.6870	**41.7**
41.8	0·0597	0.0870	0.4913	0.9481	0.2341	0.3415	1.2079	0.6863	0.3512	0.9766	0.6854	**41.8**
41.9	0.0598	0.0875	0.4912	0.9478	0.2346	0.3431	1.2094	0.6864	0.3513	0.9764	0.6837	**41.9**
42.0	0.0599	0.0879	0.4912	0.9476	0.2351	0.3447	1.2108	0.6865	0.3514	0.9763	0.6821	**42.0**
42.1	0.0601	0.0883	0.4911	0.9473	0.2356	0.3463	1.2123	0.6866	0.3515	0.9762	0.6805	**42.1**
42.2	0.0602	0.0887	0.4911	0.9471	0.2362	0.3479	1.2137	0.6867	0.3516	0.9761	0.6789	**42.2**
42.3	0.0603	0.0891	0.4911	0.9469	0.2367	0.3494	1.2151	0.6868	0.3517	0.9760	0.6773	**42.3**
42.4	0.0605	0.0895	0.4910	0.9466	0.2372	0.3510	1.2166	0.6869	0.3518	0.9759	0.6757	**42.4**
42.5	0.0606	0.0899	0.4910	0.9464	0.2377	0.3526	1.2180	0.6870	0.3519	0.9758	0.6741	**42.5**
42.6	0.0608	0.0903	0.4909	0.9461	0.2382	0.3542	1.2194	0.6871	0.3519	0.9757	0 6725	**42.6**
42.7	0.0609	0.0908	0.4909	0.9459	0.2387	0.3559	1.2209	0.6872	0.3520	0.9755	0.6709	**42.7**
42.8	0.0610	0.0912	0.4908	0.9456	0.2393	0.3575	1.2223	0.6873	0.3521	0.9754	0.6693	**42 8**
42.9	0.0612	0.0916	0.4908	0.9454	0.2398	0.3590	1.2237	0.6874	0.3522	0.9753	0.6678	**42.9**
43.0	0.0613	0.0920	0.4908	0.9451	0.2403	0.3607	1.2252	0.6875	0.3523	0.9752	0.6662	**43.0**
43.1	0.0614	0.0924	0.4907	0.9449	0.2408	0.3623	1.2266	0.6876	0.3524	0.9751	0.6647	**43.1**
43.2	0.0616	0.0929	0.4907	0.9446	0.2413	0.3639	1.2280	0.6877	0.3525	0.9750	0.6631	**43.2**
43.3	0.0617	0.0933	0.4906	0.9444	0.2418	0.3655	1.2294	0.6878	0.3526	0.9749	0.6616	**43.3**
43.4	0.0618	0.0937	0.4906	0.9441	0.2423	0.3671	1.2308	0.6879	0.3527	0.9747	0.6601	**43.4**
43.5	0.0620	0.0941	0.4905	0.9439	0.2428	0.3887	1.2323	0.6880	0.3528	0.9746	0.6586	**43.5**
43.6	0.0621	0.0945	0.4905	0.9436	0.2434	0.3703	1.2337	0.6881	0.3529	0.9745	0.6571	**43.6**
43.7	0.0623	0.0950	0.4905	0.9434	0.2439	0.3720	1.2351	0.6882	0.3530	0.9744	0.6556	**43.7**
43.8	0.0624	0.0954	0.4904	0.9431	0.2444	0.3736	1.2365	0.6883	0.3531	0.9743	0.6541	**43.8**
43.9	0.0625	0.0958	0.4904	0.9420	0.2449	0.3753	1.2379	0.6884	0.3532	0.9742	0.6526	**43.9**
44.0	0.0627	0.0963	0.4903	0.9426	0.2454	0.3769	1.2393	0.6885	0.3533	0.9740	0.6511	**44.0**

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 44° - 48°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	S.C.	R	θ
44.0	0.0627	0.0963	0.4903	0.9426	0 2454	0.3769	1.2393	0.6885	0.3533	0.9740	0.6511	**44.0**
44.1	0.0628	0.0967	0.4903	0.9424	0.2459	0.3786	1.2407	0.6886	0.3534	0.9739	0.6496	**44.1**
44.2	0.0629	0.0971	0.4902	0.9421	0.2464	0.3802	1.2421	0.6887	0 3535	0 9738	0.6481	**44.2**
44.3	0.0631	0.0975	0.4902	0.9419	0.2469	0.3818	1.2435	0.6888	0.3536	0.9737	0.6467	**44.3**
44.4	0.0632	0.0980	0.4902	0.9416	0.2474	0 3835	1.2449	0.6889	0.3537	0.9736	0.6452	**44.4**
44.5	0.0634	0.0984	0.4901	0.9413	0.2480	0.3851	1.2463	0.6890	0.3538	0.9735	0.6438	**44.5**
44.6	0.0635	0.0988	0.4901	0.9411	0.2485	0.3868	1.2477	0.6891	0.3539	0.9733	0 6423	**44.6**
44.7	0.0636	0.0993	0.4900	0.9408	0.2490	0.3885	1.2491	0.6892	0.3540	0.9732	0.6409	**44.7**
44.8	0.0638	0.0997	0.4900	0.9406	0.2495	0.3901	1.2505	0.6894	0 3541	0.9731	0.6395	**44 8**
44.9	0.0639	0.1001	0.4899	0.9403	2.2500	0.3918	1.2519	0 6895	0.3542	0.9730	0 6380	**44.9**
45.0	0.0640	0.1006	0.4899	0.9401	0.2505	0.3935	1.2533	0.6896	0.3542	0.9729	0.6366	**45.0**
45.1	0.0642	0.1010	0.4899	0.9398	0.2510	0.3952	1.2547	0.6897	0.3543	0.9727	0 6352	**45.1**
45.2	0.0643	0.1015	0.4898	0.9395	0.2515	0.3968	1.2561	0.6898	0.3544	0.9726	0.6338	**45.2**
45.3	0.0644	0.1019	0.4898	0.9393	0.2520	0.3985	1.2575	0.6899	0.3545	0.9725	0.6324	**45.3**
45.4	0.0646	0.1023	0.4897	0.9390	0.2525	0.4002	1.2589	0.6900	0.3546	0.9724	0.6310	**45.4**
45.5	0.0647	0.1028	0.4897	0.9388	0.2530	0.4019	1.2603	0.6901	0.3547	0.9723	0.6296	**45.5**
45.6	0.6048	0.1032	0.4896	0.9385	0.2535	0.4036	1.2616	0.6902	0.3549	0.9721	0.6282	**45.6**
45.7	0.0650	0.1036	0.4896	0.9382	0.2540	0.4052	1.2630	0.6903	0.3550	0.9720	0.6269	**45.7**
45.8	0.0651	0.1041	0.4895	0.9380	0.2545	0.4069	1.2644	0.6904	0.3541	0.9719	0.6255	**45.8**
45.9	0.0652	0.1045	0.4895	0.9377	0.2550	0.4087	1.2658	0.6906	0.3552	0.9718	0.6241	**45.9**
46.0	0.0654	0.1050	0.4895	0.9374	0.2556	0.4103	1.2672	0.6907	0.3553	0.9717	0.6228	**46.0**
46.1	0.0655	0.1054	0.4894	0.9372	0.2561	0.4121	1.2685	0.6908	0.3554	0.9715	0.6214	**46.1**
46.2	0.0657	0.1059	0.4894	0.9369	0.2566	0.4137	1.2699	0.6909	0.3555	0.9714	0.6201	**46.2**
46.3	0.0658	0.1063	0.4893	0.9366	0.2571	0.4155	1.2713	0.6910	0.3556	0.9713	0.6187	**46.3**
46.4	0.0659	0.1068	0.4893	0.9364	0.2576	0.4172	1.2727	0.6911	0.3557	0.9712	0.6174	**46.4**
46.5	0.0661	0.1072	0.4892	0.9361	0.2581	0.4189	1.2740	0.6912	0.3558	0.9710	0.6161	**46.5**
46.6	0.0662	0.1077	0 4892	0.9358	0.2586	0.4206	1.2754	0.6913	0.3559	0.9709	0.6148	**46.6**
46.7	0.0663	0.1081	0.4891	0.9356	0.2591	0.4224	1.2768	0.6915	0.3560	0.9708	0.6134	**46.7**
46.8	0.0665	0.1086	0.4891	0.9353	0.2596	0.4241	1.2781	0.6916	0.3561	0.9707	0.6121	**46.8**
46.9	0.0666	0.1090	0.4390	0.9350	0.2601	0.4258	1.2795	0.6917	0.3562	0.9705	0 6108	**46.9**
47.0	0.0667	0.1095	0.4890	0.9348	0.2606	0.4275	1.2809	0.6918	0.3563	0.9704	0.6095	**47.0**
47.1	0.0669	0.1100	0.4890	0.9345	0.2611	0.4293	1.2822	0.6919	0.3564	0.9703	0.6082	**47.1**
47.2	0.0670	0.1104	0.4889	0.9342	0.2616	0.4310	1.2836	0.6920	0.3565	0.9702	0.6069	**47.2**
47.3	0.0672	0.1109	0.4889	0.9340	0.2621	0.4327	1.2849	0.6921	0.3566	0.9700	0.6057	**47.3**
47.4	0.0673	0.1113	0.4888	0.9337	0.2626	0.4344	1.2863	0.6923	0.3567	0.9699	0.6044	**47.4**
47.5	0.0674	0.1118	0.4888	0.9334	0.2631	0.4362	1.2877	0.6924	0.3568	0.9698	0.6031	**47.5**
47.6	0.0676	0.1122	0.4887	0.9332	0.2636	0.4380	1.2890	0.6925	0.3569	0.9697	0.6018	**47.6**
47.7	0.0677	0.1127	0.4887	0.9329	0.2641	0.4397	1.2904	0.6926	0.3570	0.9695	0.6006	**47.7**
47.8	0.0678	0.1132	0.4886	0.9326	0.2646	0.4415	1.2917	0.6927	0.3571	0.9694	0.5993	**47.8**
47.9	0.0680	0.1136	0.4886	0.9323	0.2651	0.4432	1.2931	0.6928	0.3572	0.9693	0.5981	**47.9**
48.0	0.0681	0.1141	0.4885	0.9321	0.2656	0.4450	1.2944	0.6930	0.3574	0.9692	0.5968	**48.0**

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

θ = 48° — 60°

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
48.0	0.0681	0.1141	0.4885	0.9321	0.2656	0.4450	1.2944	0.6930	0.3574	0.9692	0.5968	48.0
48.1	0.0682	0.1145	0.4885	0.9318	0.2661	0.4467	1.2958	0.6931	0.3575	0.9690	0.5956	48.1
48.2	0.0684	0.1150	0.4884	0.9315	0.2666	0.4485	1.2971	0.6932	0.3576	0.9689	0 5944	48.2
48.3	0.0685	0.1155	0.4884	0.9312	0.2671	0.4503	1.2985	0.6933	0.3577	0.9688	0.5931	48.3
48.4	0.0686	0.1159	0.4883	0.9310	0.2676	0.4520	1.2988	0.6934	0.3578	0.9687	0.5919	48.4
48.5	0.0688	0.1164	0.4883	0.9307	0.2681	0.4538	1.3011	0.6935	0.3579	0.9685	0.5907	48.5
48.6	0.0689	0.1169	0.4882	0.9304	0.2685	0.4555	1.3025	0.6937	0.3580	0.9684	0.5895	48.6
48.7	0.0690	0.1173	0.4882	0.9301	0.2690	0.4573	1.3038	0.6938	0.3581	0.9683	0.5883	48.7
48.8	0.0692	0.1178	0.4882	0.9299	0.2695	0.4592	1.3052	0.6939	0.3582	0.9681	0.5870	48.8
48.9	0.0693	0.1183	0.4881	0.9296	0.2700	0.4610	1.3065	0.6940	0.3583	0.9680	0.5858	48.9
49.0	0.0694	0.1188	0.4881	0.9293	0.2705	0.4627	1.3078	0.6941	0.3584	0.9679	0.5847	49.0
49.1	0.0696	0.1192	0.4880	0.9290	0.2710	0.4645	1.3092	0.6943	0.3586	0.9677	0.5835	49.1
49.2	0.0697	0.1197	0.4880	0.9287	0.2715	0.4663	1.3105	0.6944	0.3587	0.9676	0.5823	49.2
49.3	0.0698	0.1202	0.4879	0.9285	0.2720	0.4681	1.3118	0.6945	0.3588	0.9675	0.5811	49.3
49.4	0.0700	0.1207	0.4879	0.9282	0.2725	0.4699	1.3132	0.6946	0.3589	0.9674	0.5799	49.4
49.5	0.0701	0.1211	0.4878	0.9279	0.2730	0·4717	1.3145	0.6948	0.3590	0.9672	0.5787	49.5
49.6	0.0702	0.1216	0.4878	0.9276	0.2735	0.4735	1.3158	0.6949	0.3591	0.9671	0.5776	49.6
49.7	0.0704	0.1221	0.4877	0.9273	0.2740	0.4753	1.3171	0.6950	0.3592	0.9670	0.5764	49.7
49.8	0.0705	0.1225	0.4877	0.9271	0.2745	0.4771	1.3185	0.6951	0.3593	0.9668	0.5753	49.8
49.9	0.0706	0.1230	0.4876	0.9268	0.2750	0.4789	1.3198	0.6952	0.3595	0.9667	0.5741	49.9
50.0	0.0708	0.1235	0.4876	0.9265	0.2754	0.4807	1.3211	0.6954	0.3596	0.9666	0.5730	50.0
50.5	0.0714	0.1259	0.4873	0.9250	0.2779	0.4898	1.3277	0.6960	0.3601	0.9659	0.5673	50.5
51.0	0.0721	0.1284	0.4871	0 9236	0.2803	0.4991	1.3343	0.6966	0.3607	0.9652	0.5617	51.0
51.5	0.0728	0.1308	0.4868	0.9222	0.2828	0.5083	1.3408	0.6972	0.3613	0.9645	0.5563	51.5
52.0	0.0734	0.1333	0.4866	0.9207	0.2852	0.5177	1.3473	0.6979	0.3619	0.9639	0.5509	52.0
52.5	0.0741	0.1358	0.4863	0.9192	0.2876	0.5270	1.3537	0.6986	0.3625	0.9622	0.5457	52.5
53.0	0.0748	0.1383	0.4861	0.9178	0.2900	0.5366	1.3602	0.6992	0.3631	0.9625	0.5405	53.0
53.5	0.0754	0.1409	0.4858	0.9163	0.2924	0.5461	1.3666	0.6999	0.3638	0.9618	0.5355	53.5
54.0	0.0761	0.1434	0.4856	0.9148	0.2948	0.5557	1.3729	0.7006	0.3644	0.9611	0.5305	54.0
54.5	0.0768	0.1460	0.4853	0.9132	0.2972	0.5654	1.3793	0.7013	0.3650	0.9604	0.5256	54.5
55.0	0.0774	0.1486	0.4850	0.9117	0.2995	0.5750	1.3856	0.7020	0.3657	0.9596	0.5209	55.0
55.5	0.0781	0.1512	0.4848	0.9102	0.3019	0.5848	1.3919	0.7027	0.3663	0.9589	0.5162	55.5
56.0	0.0787	0.1539	0.4845	0.9086	0.3042	0.5947	1.3981	0.7034	0.3670	0.9582	0.5116	56.0
56.5	0.0794	0.1566	0.4842	0.9070	0.3066	0.6047	1.4044	0.7041	0.3676	0.9575	0.5070	56.5
57.0	0.0800	0.1592	0.4840	0.9055	0.3089	0.6146	1.4106	0.7049	0.3683	0.9567	0.5026	57.0
57.5	0.0807	0.1620	0 4837	0.9039	0.3112	0.6247	1.4167	0.7056	0.3690	0.9560	0.4982	57.5
58.0	0.0813	0.1647	0.4834	0.9023	0.3135	0.6348	1.4229	0.7064	0.3697	0.9552	0.4939	58.0
58.5	0.0820	0.1674	0.4831	0.9007	0.3158	0.6449	1.4290	0.7071	0.3704	0.9544	0.4897	58.5
59.0	0.0826	0.1702	0.4828	0.8990	0.3181	0.6551	1.4351	0.7075	0.3711	0.9537	0.4856	59.0
59.5	0.0833	0.1730	0.4826	0.8974	0.3204	0.6654	1.4412	0.7087	0.3718	0.9529	0.4815	59.5
60.0	0.0839	0.1758	0.4823	0.8958	0.3227	0.6757	1.4472	0.7095	0.3726	0.9521	0.4775	60.0

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 60° - 90°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
60.0	0.0839	0.1758	0.4823	0.8958	0.3227	0.6757	1.4472	0.7095	0.3726	0.9521	0.4775	**60.0**
60.5	0.0846	0.1786	0.4820	0.8941	0.3249	0.6862	1.4532	0.7102	0.3730	0.9513	0.4735	**60.5**
61.0	0.0852	0.1815	0.4817	0.8925	0.3272	0.6967	1.4592	0.7107	0.3741	0.9508	0.4996	**61.0**
61.5	0 0859	0.1843	0.4814	0.8908	0.3294	0.7072	1.4652	0.7119	0.3748	0.9497	0.4658	**61.5**
62.0	0.0865	0.1872	0.4811	0.8891	0.3316	0.7177	1.4711	0.7128	0.3754	0.9489	0.4621	**62.0**
62.5	0.0871	0 1901	0.4808	0.8874	0.3339	0.7283	1.4770	0.7136	0.3764	0.9481	0.4584	**62.5**
63.0	0.0878	0.1930	0.4805	0.8857	0.3361	0.7391	1.4829	0.7145	0.3772	0.9473	0.4547	**63.0**
63.5	0 0884	0.1960	0.4802	0.8840	0.3383	0.7498	1.4888	0.7153	0.3780	0.9465	0.4511	**63.5**
64.0	0.0890	0.1989	0.4799	0.8822	0.3404	0.7606	1.4947	0.7162	0.3788	0.9457	0.4476	**64.0**
64.5	0.0897	0.2019	0.4796	0.8805	0.3426	0.7713	1.5005	0.7171	0.3796	0.9448	0 4442	**64.5**
65.0	0.0903	0.2049	0.4793	0.8787	0.3448	0.7823	1.5063	0.7180	0.3804	0.9440	0.4407	**65.0**
65.5	0.0909	0.2079	0.4790	0.8770	0.3469	0.7932	1.5121	0.7190	0.3813	0.9431	0.4374	**65.5**
66.0	0.0916	0.2109	0.4787	0.8752	0.3491	0.8041	1.5178	0.7198	0.3821	0.9423	0.4341	**66.0**
66.5	0.0922	0.2140	0.4784	0.8734	0.3512	0.8153	1.5236	0.7207	0.3830	0.9414	0.4308	**66.5**
67.0	0.0928	0.2171	0.4781	0.8717	0.3533	0.8263	1.5293	0.7217	0.3838	0.9405	0.4276	**67.0**
67.5	0.0934	0.2202	0.4777	0.8699	0.3555	0.8375	1.5350	0.7226	0.3847	0.9397	0.4244	**67.5**
68.0	0.0941	0.2233	0.4774	0.8680	0.3576	0.8487	1.5407	0.7236	0.3856	0.9388	0.4213	**68.0**
68.5	0.0947	0.2264	0.4771	0.8662	0.3591	0.8588	1.5463	0.7248	0.3860	0.9377	0.4182	**68.5**
69.0	0.0953	0.2296	0.4768	0.8644	0.3617	0.8712	1.5520	0.7255	0.3874	0.9370	0.4152	**69.0**
69.5	0.0959	0.2327	0.4765	0.8626	0.3638	0.8825	1.5576	0.7265	0.3884	0.9361	0.4122	**69.5**
70.0	0.0966	0 2359	0.4761	0.8607	0.3658	0.8939	1.5632	0.7276	0.3893	0.9352	0.4093	**70.0**
71.0	0 0978	0.2423	0 4755	0.8570	0.3699	0.9168	1.5743	0.7296	0.3912	0.9334	0.4035	**71.0**
72.0	0.0990	0.2488	0.4748	0.8532	0.3739	0.9398	1.5853	0.7317	0.3932	0.9310	0.3979	**72.0**
73.0	0.1002	0.2554	0.4741	0.8494	0.3779	0.9630	1.5963	0.7339	0.3952	0.9291	0.3924	**73.0**
74.0	0.1014	0.2620	0.4735	0.8456	0.3819	0.9864	1.6072	0.7361	0.3973	0.9278	0.3871	**74.0**
75.0	0.1026	0.2687	0.4728	0.8417	0.3858	1.0099	1.6180	0.7384	0.3994	0.9259	0.3820	**75.0**
76.0	0.1038	0.2755	0.4721	0 8378	0.3896	1.0336	1.6288	0.7407	0.4015	0.9240	0.3769	**76.0**
77.0	0.1050	0.2823	0.4714	0.8339	0.3934	1.0574	1.6395	0.7431	0.4037	0.9220	0.3721	**77.0**
78.0	0.1062	0.2892	0.4707	0.8299	0.3971	1.0813	1.6501	0.7455	0.4060	0.9200	0 3673	**78.0**
79.0	0.1074	0.2962	0.4699	0.8259	0.4008	1.1054	1.6606	0.7480	0.4083	0.9180	0.3626	**79.0**
80.0	0.1086	0.3032	0.4692	0.8219	0.4045	1.1296	1.6711	0.7505	0.4107	0.9160	0.3581	**80.0**
81.0	0.1097	0.3103	0.4685	0.8178	0.4081	1.1539	1.6815	0.7532	0.4132	0.9140	0.3537	**81.0**
82.0	0.1109	0.3175	0.4677	0.8137	0.4117	1.1783	1.6918	0.7559	0.4157	0.9119	0.3494	**82.0**
83.0	0.1121	0.3247	0.4670	0.8096	0.4151	1.2027	1.7021	0.7586	0.4183	0.9098	0.3452	**83.0**
84.0	0.1132	0.3319	0 4662	0.8054	0.4186	1.2274	1.7124	0.7614	0.4209	0.9077	0.3410	**84.0**
85.0	0.1144	0.3393	0.4655	0.8012	0.4220	1.2521	1.7225	0.7643	0.4236	0.9056	0.3370	**85.0**
86.0	0.1155	0.3467	0.4647	0.7970	0.4254	1.2769	1.7326	0.7673	0.4264	0.9034	0.3331	**86.0**
87.0	0.1166	0.3541	0.4639	0.7928	0.4287	1.3018	1.7427	0.7703	0.4293	0.9012	0.3293	**87.0**
88.0	0.1177	0.3616	0.4632	0.7885	0.4319	1.3267	1.7526	0.7734	0.4322	0.8991	0.3255	**88.0**
89.0	0.1188	0.3692	0.4624	0.7842	0.4351	1.3519	1.7626	0.7766	0.4352	0.8968	0.3219	**89.0**
90.0	0.1199	0.3768	0.4616	0.7799	0.4383	1.3768	1.7725	0.7799	0.4383	0.8946	0.3183	**90.0**

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 90° - 130°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
90.0	0.1199	0.3768	0.4616	0.7799	0.4383	1.3768	1.7725	0.7799	0.4383	0.8946	0.3183	**90.0**
91.0	0.1210	0.3845	0.4608	0.7755	0.4414	1.4020	1.7823	0.7833	0.4414	0.8923	0.3148	**91.0**
92.0	0.1221	0.3922	0.4600	0.7712	0.4444	1.4271	1.7920	0.7867	0.4447	0.8901	0.3114	**92.0**
93.0	0.1232	0.4000	0.4592	0.7668	0.4474	1.4524	1.8018	0.7902	0.4480	0.8878	0.3080	**93.0**
94.0	0.1243	0.4079	0.4583	0.7624	0.4503	1.4776	1.8114	0.7939	0.4514	0.8854	0.3048	**94.0**
95.0	0.1254	0.4157	0.4575	0.7579	0.4532	1.5029	1.8210	0.7976	0.4549	0.8831	0.3016	**95.0**
96.0	0.1264	0.4237	0.4567	0.7535	0.4560	1.5282	1.8306	0.8014	0.4586	0.8807	0.2984	**96.0**
97.0	0.1275	0.4317	0.4559	0.7490	0.4588	1.5535	1.8401	0.8053	0.4623	0.8784	0.2953	**97.0**
98.0	0.1285	0.4397	0.4550	0.7445	0.4615	1.5789	1.8496	0.8094	0.4661	0.8760	0.2923	**98.0**
99.0	0.1296	0.4478	0.4542	0.7400	0.4642	1.6042	1.8590	0.8135	0.4700	0.8735	0.2894	**99.0**
100.0	0.1306	0.4559	0.4533	0.7354	0.4668	1.6295	1.8683	0.8178	0.4740	0.8711	0.2865	**100.0**
101.0	0.1316	0.4641	0.4525	0.7309	0.4694	1.6549	1.8776	0.8221	0.4782	0.8686	0.2836	**101.0**
102.0	0.1326	0.4723	0.4516	0.7263	0.4719	1.6802	1.8869	0.8266	0.4824	0.8662	0.2809	**102.0**
103.0	0.1337	0.4805	0.4507	0.7217	0.4744	1.7055	1.8961	0.8312	0.4868	0.8637	0.2781	**103.0**
104.0	0.1347	0.4888	0.4498	0.7171	0.4768	1.7308	1.9053	0.8360	0.4914	0.8611	0.2755	**104.0**
105.0	0.1356	0.4972	0.4400	0.7125	0.4791	1.7560	1.9145	0.8409	0.4960	0.8586	0.2728	**105.0**
106.0	0.1366	0.5056	0.4481	0.7079	0.4814	1.7812	1.9236	0.8459	0.5008	0.8560	0.2703	**106.0**
107.0	0.1376	0.5140	0.4472	0.7032	0.4836	1.8064	1.9326	0.8511	0.5057	0.8535	0.2677	**107.0**
108.0	0.1386	0.5224	0.4463	0.6986	0.4858	1.8315	1.9416	0.8564	0.5108	0.8509	0.2653	**108.0**
109.0	0.1395	0.5309	0.4454	0.6939	0.4879	1.8565	1.9506	0.8619	0.5161	0.8483	0.2628	**109.0**
110.0	0.1405	0.5395	0.4445	0.6892	0.4900	1.8815	1.9595	0.8676	0.5215	0.8457	0.2604	**110.0**
111.0	0.1414	0.5480	0.4436	0.6845	0.4920	1.9064	1.9684	0.8734	0.5270	0.8430	0.2581	**111.0**
112.0	0.1424	0.5566	0.4427	0.6798	0.4940	1.9313	1.9773	0.8794	0.5328	0.8403	0.2558	**112.0**
113.0	0.1433	0.5653	0.4417	0.6751	0.4959	1.9560	1.9861	0.8856	0.5384	0.8377	0.2535	**113.0**
114.0	0.1442	0.5740	0.4408	0.6704	0.4977	1.9807	1.9948	0.8920	0.5448	0.8350	0.2513	**114.0**
115.0	0.1451	0.5827	0.4399	0.6657	0.4995	2.0053	2.0036	0.8986	0.5512	0.8323	0.2491	**115.0**
116.0	0.1461	0.5914	0.4390	0.6609	0.5013	2.0298	2.0123	0.9054	0.5577	0.8295	0.2470	**116.0**
117.0	0.1470	0.6002	0.4380	0.6562	0.5030	2.0542	2.0209	0.9125	0.5645	0.8268	0.2449	**117.0**
118.0	0.1478	0.6090	0.4371	0.6514	0.5046	2.0784	2.0295	0.9197	0.5715	0.8240	0.2428	**118.0**
119.0	0.1487	0.6178	0.4361	0.6467	0.5062	2.1026	2.0381	0.9273	0.5787	0.8212	0.2407	**119.0**
120.0	0.1496	0.6266	0.4352	0.6419	0.5077	2.1266	2.0467	0.9351	0.5862	0.8184	0.2387	**120.0**
121.0	0.1505	0.6355	0.4342	0.6372	0.5092	2.1505	2.0552	0.9431	0.5940	0.8156	0.2368	**121.0**
122.0	0.1513	0.6444	0.4333	0.6324	0.5106	2.1743	2.0636	0.9515	0.6021	0.8128	0.2348	**122.0**
123.0	0.1522	0.6533	0.4323	0.6276	0.5119	2.1980	2.0721	0.9601	0.6104	0.8099	0.2329	**123.0**
124.0	0.1530	0.6623	0.4313	0.6229	0.5132	2.2215	2.0805	0.9691	0.6191	0.8071	0.2310	**124.0**
125.0	0.1538	0.6712	0.4304	0.6181	0.5145	2.2448	2.0889	0.9784	0.6281	0.8042	0.2292	**125.0**
126.0	0.1547	0.6802	0.4294	0.6133	0.5157	2.2680	2.0972	0.9880	0.6374	0.8013	0.2274	**126.0**
127.0	0.1555	0.6892	0.4284	0.6086	0.5168	2.2911	2.1055	0.9980	0.6471	0.7984	0.2256	**127.0**
128.0	0.1563	0.6983	0.4275	0.6038	0.5179	2.3139	2.1138	1.0084	0.6572	0.7955	0.2238	**128.0**
129.0	0.1571	0.7073	0.4265	0.5991	0.5189	2.3366	2.1220	1.0193	0.6677	0.7925	0.2221	**129.0**
130.0	0.1579	0.7164	0.4255	0.5943	0.5199	2.3592	2.1302	1.0305	0.6787	0.7896	0.2204	**130.0**

Appendix 5

TABLE-12. FUNCTIONS OF TRANSITION SPIRALS

$\theta = 130° - 135°$

θ	Sx	$\frac{Sx}{R}$	K	X	Y	Y/R	L	L.T.	S.T.	L.C.	R	θ
130.0	0.1579	0.7164	0.4255	0.5943	0.5199	2.3592	2.1302	1.0305	0.6787	0.7896	0.2204	**130.0**
131.0	0.1586	0.7255	0.4245	0.5895	0.5208	2.3815	2.1384	1.0423	0.6901	0.7866	0.2187	**131.0**
132.0	0.1594	0.7345	0.4235	0.5848	0.5217	2.4037	2.1465	1.0545	0.7020	0.7837	0.2170	**132.0**
133.0	0.1602	0.7437	0.4225	0.5800	0.5225	2.4257	2.1547	1.0673	0.7144	0.7807	0.2154	**133.3**
134.0	0.1609	0.7528	0.4215	0.5753	0.5232	2.4474	2.1627	1.0806	0.7274	0.7777	0.2138	**134.0**
135.0	0.1617	0.7619	0.4205	0.5706	0.5239	2.4690	2.1708	1.0945	0.7410	0.7746	0.2122	**135.0**